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ANALYSIS OF ONE HUNDRED CONSECUTIVE CASES OF AURAL DISEASE IN AN ARMY GENERAL HOSPITAL

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This paper deals with the cases of the first 100 patients with aural disease who were admitted to the Tilton General Hospital. An analysis with special reference to the cause and the treatment of the aural disease and the ultimate disposition of the patients was undertaken in order to afford an understanding of aural disease as it occurs in the United States Army. The American soldier is healthy and generally free from constitutional disease. The physical examination given before induction eliminates the majority of men with pathologic conditions. Those who are accepted profit by an active, health-building program.

The series comprised 4.3 per cent of the first 2,290 patients admitted to the hospital for all causes. The average age of this group was 25.9 years; 78 per cent of the men were between 20 and 30 years, 14 per cent over 30 years and 8 per cent under 20 years of age (fig. 1). The average length of service was twenty-eight months, while only 8 per cent had served more than two years.

The patients were divided into two main groups, those with a suppurative disease and those with deafness. Patients suffering with purulent otitis media presented the main problem in therapy. In general they had been observed and treated in station hospitals for one or two months before being referred to the general hospital for final disposition. They had failed to respond to all types of therapy. Many presented diagnostic problems. Of the 77 patients in this classification, 59 had chronic and 18 had acute aural disease. Forty-seven patients gave a history of having had a discharging ear for more than fifteen years. Eight had had scarlet fever; 5, measles; 1, diphtheria, and 1, pertussis, at the time of onset. The remaining 32 could recall no etiologic factor. Eighteen patients suffered with acute otitis media. In 2 of these this disease followed trauma of the head, and in 16, infection of the upper respiratory tract.

In the patients with chronic aural disease the conditions in the middle ear varied. In a large percentage of the patients foul pus with polyps or with granulation tissue was encountered in the middle ear. The tympanic membrane and portions of the ossicles had been destroyed in most of these persons. A smaller percentage of the patients presented perforation of the attic with evidence of cholesteatoma. In some persons the perforation was small and the discharge scanty.

Acute otitis media was rarely encountered in its early phase. As evidence of this circumstance is the fact that the thickened, red, bulging drum typical of this condition was seen in only a few patients.

TREATMENT

Nonsurgical Treatment.—Practically all of the patients with suppurative disease of the ear had received substantial prolonged doses of one of the sulfona-

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mide compounds (sulfathiazole, sulfanilamide or sulfadiazine) by mouth and locally before admission to this general hospital. Nevertheless, all patients on admission received the benefit of conservative therapy. The ears were cleansed every second or third day, mopped with 95 per cent alcohol and dried with compressed warm air; then a thin layer of sulfanilamide powder was blown into the ears. Sulfathiazole powder caked and hardened and proved unsatisfactory. When a chronic lesion was accessible, topical application of sulfanilamide powder proved helpful. Twenty of the patients with the mildest chronic conditions and 11 of the 18 with acute involvement recovered as a result of conservative treatment.

Surgical Treatment.—Simple mastoidectomy by means of a postaural incision was performed on 7 of the patients with acute conditions. The 26 patients with chronic suppurative conditions who did not respond to conservative therapy received some form of radical surgical treatment. The endaural radical mastoidectomy was performed on 15, the endaural modified radical mastoidectomy on 7 and the postauricular radical mastoidectomy on the remaining 4.

The patients with chronic aural disease that required surgical treatment presented some unusual problems. The patients with good hearing and a small

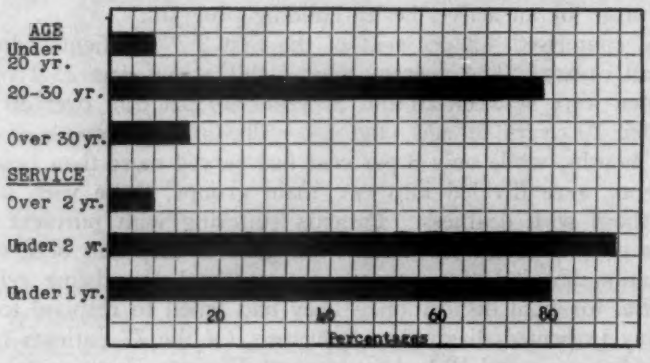

Fig. 1.—Relative percentages of age groups and periods of service of the soldiers.

perforation in an apparently healthy tympanic membrane in whom the discharge persisted underwent the modified radical mastoidectomy according to Lempert's technic, after toilet of the nose and throat had been completed. Those with no drum and with poor hearing who had a copious, foul, purulent discharge received the radical mastoidectomy. Those with no drum and with good hearing were returned to limited duty with a draining ear. Such complaints as headache, earache, tinnitus, intermittent vertigo and nausea were carefully evaluated, together with the picture of the middle ear and the results of the roentgen examination. Acuity of hearing was tested by the audiometer or by the spoken voice. Caloric tests were carried out in most of the cases. None of the patients presented a positive reaction to the fistula test or any evidence of intracranial extension. Five of the radical procedures were revisions of previous mastoidectomies. Two patients had been operated on once; 2, twice, and 1, 3 times before admission. Three of these patients had cholesteatoma.

An appreciation of the surgical technic is best realized by referring to Lempert's work.[1] He divided the operation into three stages: first, the procedure on

1. Lempert, J.: Endaural, Antauricular Surgical Approach to the Temporal Bone, Arch. Otolaryng. **27**:555-587 (May) 1938.

the soft parts covering the temporal bone; second, the technic on the temporal bone, and, third, the postoperative management.

Intratracheal ether anesthesia was used in all cases. The postoperative course was uneventful. In order to control bleeding, a 1:10,000 solution of epinephrine hydrochloride was injected into the area to be incised.

For the modified mastoidotympanectomy (modified radical) a mobile extracartilaginous window [2] was created. The first incision extended from the superoposterior wall of the canal to the lower end of the anterior border of the concha. The second incision continued from the extreme upper portion of the first, through the anterior part of the antauricular suprameatal triangle adjacent to the tragus.

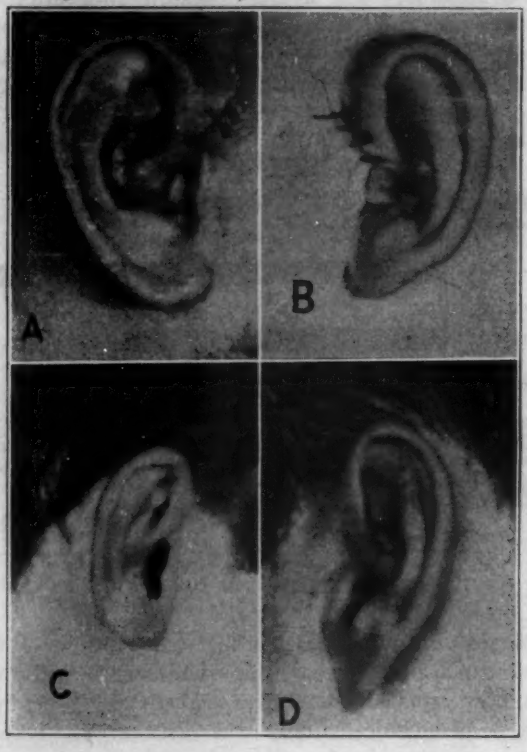

Fig. 2.—*A* and *B*, endaural mastoidectomies on the first postoperative day. *C* and *D*, healed endaural mastoidectomies.

The third incision connected these two by extending along the anterior border of the concha. The periosteum of the temporal bone was then thoroughly freed, and the incised, triangular, wedge-shaped portion of the fibrocutaneous tissue removed. The mobility of this extracartilaginous endaural window afforded a completely satisfactory exposure for the surgical procedure that was performed.

A slightly curved prehelix and anticonchal incision [3] was utilized in the mastoidotympanectomies (radical mastoidectomies). After the operation on the bone was completed, the flap was freed along the superior portion of the external

2. Lempert, J.: Improvement of Hearing in Cases of Otosclerosis, Arch. Otolaryng. **28**: 42-97 (July) 1938.

3. Kettel, K.: The Lempert Endaural, Antauricular Surgical Approach to the Temporal Bone, Arch. Otolaryng. **34**:461-472 (Sept.) 1941.

canal and manipulated over the facial ridge and into the excavated mastoid process. As a result, a small amount of the epithelium of the external canal was saved, the flap was larger, and the facial ridge was covered by this maneuver. The healing process was thereby enhanced and the convalescence shortened. To insure a less conspicuous scar, three black silk sutures were used in the external cutaneous wound. To facilitate exposure of the middle ear, in several of the modified radical procedures the incus and the head and neck of the malleus were removed. Two patients with cholesteatoma in the epitympanum were successfully handled in this manner.

A primary Thiersch graft was attempted in 6 of the radical mastoidectomies, and a secondary graft was made about two weeks after radical or modified radical mastoidectomy on 8 patients. The average healing time after radical procedures without graft was two and one-half months, while after operations in which grafts were used it was slightly less than two months. When a large primary graft "took," the healing time was shorter than it was when a secondary graft was employed. Frequently areas of the graft would not "take." This circumstance was always followed by profuse foul drainage, and localized débridement had to be carried out.

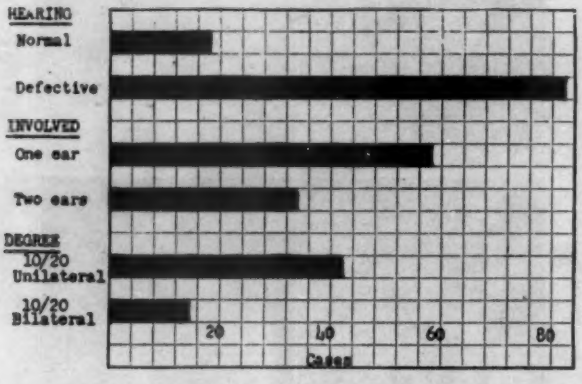

Fig. 3.—Chart showing number of patients and degrees of deafness.

Unusual pathologic changes were revealed at the time of the operation in a number of patients. In 3 there were definite dehiscences in the fallopian canal just above the oval window; this fact was demonstrated by touching the facial nerve with a probe. In 5 men cholesteatoma was discovered. Exposure of the dura of the middle fossa was seen in 4 men, and of the posterior fossa, in 3. In 1 man a cholesteatoma eroded the wall of the external semicircular canal almost to the endosteum.

Paresis of the facial nerve occurred in 2 patients in the group subjected to radical mastoidectomy. In each instance there was a dehiscence of the fallopian canal. Both patients recovered. Two patients exhibited marked labyrinthine disturbance with nausea, vomiting, vertigo and spontaneous nystagmus. One of these had an incomplete fenestration by a cholesteatoma. There were no other postoperative complications of any kind. Ears of two patients are still discharging purulent material; another patient, who deserted a week after operation, returned ten months later with a dry ear.

DEAFNESS GROUP

The lack of acute hearing, so essential in modern warfare, is a serious handicap. Only 18 of the 100 men whose cases were under review had normal hearing

(fig. 3). Fifty-eight had defective hearing in one ear, while in 34 the hearing was affected in both ears. Forty-two presented a 50 per cent loss of hearing in one ear, and 14, a 50 per cent loss in both ears.

The causes of the deafness of this group varied. Otitis media, both purulent and nonpurulent, was responsible for the condition in 47 men, exanthematous diseases in 15; trauma of the head [4] in 11; otosclerosis, in 7, and noise, in 2. In 2 cases of injury of the head there were both a dead cochlea and a dead labyrinth, and in another case there was a dead cochlea.[5] Measles, meningococcic meningitis and a previous radical mastoidectomy were responsible for the complete deafness in the other cases. Forty-nine of the patients had active infections, and the remaining 33 had dry ears. The treatment in the cases of deafness with suppuration on the whole was limited. It included an analysis of the type of deafness and application of available therapy to the causative factors. The condition of the nose and throat improved. The patients who presented aural infection were treated locally and

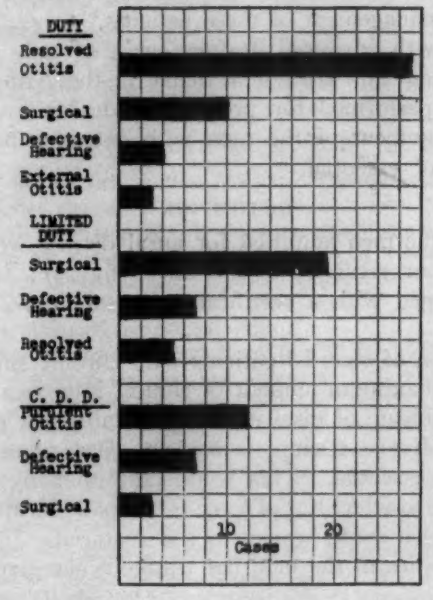

Fig. 4.—Chart showing number of patients returned to full military duty, number returned to limited duty and number discharged from the service, and the specific condition which determined the disposition.

surgically. Warm, dry climates, with restrictions on swimming, were recommended.

The patients with head injury had the most severe type of deafness and the more complex symptoms. All the patients had been unconscious for a varying length of time. Their complaints of such conditions as headache, tinnitus, deafness, vertigo and sensitivity to changes in weather were persistent [6] and disturbing. In 9 of the patients deafness resulted from injuries sustained in automobile accidents;

4. Grove, W. E.: Skull Fractures Involving the Ear: A Clinical Study of Two Hundred and Eleven Cases, Laryngoscope **49**:678 and 833, 1939.

5. Bunch, C. C.: Traumatic Deafness, cited by Fowler, E. P., Jr.: Medicine of the Ear, New York, Thos. Nelson & Sons, 1939, pp. 349-365.

6. Swift, G.: Cerebral Injuries Due to External Trauma, Surg., Gynec. & Obst. **62**:340, 1936.

1 patient was struck with a baseball bat, and another was struck in the ear while boxing. One of these men revealed roentgen evidence of fracture of the squamous portion of the temporal bone. The treatment consisted of immediate and prolonged rest in bed. Two of these patients had purulent otitis media; in 1 it resolved spontaneously and the other underwent a simple mastoidectomy.

In deafness due to noise, the best form of treatment has been that of prophylaxis. The characteristic audiometric tracing is indicative of a high note deafness. Ear plugs have been in wide usage for years. Neither the machine gunner, with nine months of active duty, nor the heavy artillery officer, with twenty-nine years of service, was conscientious about their use, however. It is noteworthy that in only 2 of the 100 cases under study was defective hearing due to noise.

The men with otosclerosis were the most unhappy group of patients. They were poorly adjusted and frequently depressed. Only 2 of them returned to duty. Three went to limited duty, and 2 were discharged. Encouragement and psychotherapy were applied when indicated. The neurologic and neuropsychiatric departments assisted in the management of these patients.[7]

Most of the men with advanced deafness were already inadvertently reading lips. At present hearing aids are not available in the Army and no fenestration operations have been performed for progressive deafness. The main objective, however, was the assignment of the men with defective hearing to jobs where perfect hearing was not essential.

DISPOSITION

Three quarters of the men admitted for aural disease were salvaged for some type of duty. Forty-four returned to full duty (fig. 4); 31 returned to limited duty; 22 were discharged with a certificate of disability; 2 were retired, and 1 deserted.

Before the declaration of war, 13 patients with chronic suppurative otitis media who had received the maximum amount of clinical improvement were returned to civilian life with a certificate of discharge for disability. At present, such men are sent to limited duty. Every attempt is made to place them in a position where perfect hearing is not essential. This is difficult in many instances, because of the unusual emotional characteristics of some of the patients and the scarcity of satisfactory positions in which acute hearing is not required. It is obvious that these men are not only liabilities in the field but distinctly dangerous to themselves and their associates.

SUMMARY

An analysis of the cases of the first 100 patients with aural disease admitted to the Tilton General Hospital has been presented with reference to the cause and treatment of the condition and the disposition of the patients. Approximately 4.3 per cent of the first 2,290 patients admitted for all causes had aural disease. Seventy-seven per cent of the patients with aural disease had a suppurative condition. Eighty-five per cent presented some type and degree of deafness. Thirty-three per cent underwent some form of surgical intervention. Approximately 75 per cent of these men with disease of the ear were saved for limited duty or for full duty.

Major Marshall B. Stewart and Captain Merton N. Flanders, Medical Corps, United States Army, cooperated in the diagnosis and the treatment.

Tilton General Hospital.

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7. Lempert, J.: Endaural Fenestration of External Semicircular Canal for Restoration of Hearing in Cases of Otosclerosis, Arch. Otolaryng. **31**:711-779 (May) 1940.

INCORRECT TREATMENT OF OSTEOMYELITIS OF THE FRONTAL BONE

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"The period before 1941 might be appropriately designated as 1941 B. C. (before chemotherapy), whereas, the period after 1941 could be christened A. D. (after diazine). I am convinced that chemotherapy will surely modify, even revolutionize, the treatment of osteomyelitis." [1]

This and similar statements appearing in recent articles on osteomyelitis of the frontal bone furnish the real incentive for writing this paper. I was lulled into a feeling of false security and neglected to follow out the surgical procedures that I had advocated in previous writings.[2]

The following report of a case may be the means of warning others that chemotherapy is not always successful.

REPORT OF A CASE

A woman aged 35, the mother of two children, suffered from chronic pansinusitis with questionable allergy. I had examined her on various occasions during the past fifteen years. Twelve years ago I had performed a Caldwell-Luc operation on her left antrum, an intranasal ethmoidectomy and an intranasal operation on the right antrum. This gave only temporary relief. Two years later she had surgical treatment for an acute involvement of the left mastoid. Healing was without incident. After this she was operated on elsewhere for "sinus trouble" without obtaining permanent relief.

In the meantime she had married and lived in Chicago. During the past three years chronic bronchitis had developed and she had a profuse foul discharge from both nostrils, a productive cough and daily frontal headache. She was under the care of an excellent and conservative rhinologist, who advised that she should have an external operation on both sides for the chronic disease of the ethmoid, sphenoid and frontal sinuses.

Because her parents lived in Boise, Idaho, and her two children could be cared for more easily there than in Chicago and because she had survived my earlier operations without mishap, she returned to Boise, with the approval of my Chicago confrere.

The internist reported her general condition to be good except for some moist rales and a peribronchial thickening which he thought was due to her chronic sinus infection. The radiologist reported dense clouding of all paranasal sinuses with loss of aeration. The sphenoid sinuses were small and densely clouded.

I felt appprehensive about my patient, and I decided to hospitalize her and to give her a course of sulfathiazole (2-[paraaminobenzenesulfonamido]-thiazole) before operation. The white blood cell count was 10,500. Beginning on Feb. 8, 1942, 15 grains (0.97 Gm.) of sulfathiazole was given every three hours. Three days later the level of sulfathiazole in the blood was 18 mg. per hundred cubic centimeters; the white blood cell count was 10,800. A careful check was made on her intake and output of fluids, and the urine was examined carefully for crystals.

With the region under local anesthesia induced with morphine and pentobarbital sodium, the right side was operated on. An external curvilinear incision was made, and the remaining anterior and posterior ethmoid cells were exenterated thoroughly. The frontal sinus, which was small, was opened, and the floor was removed. The sphenoid sinus was opened and the anterior wall taken down. All diseased lining was carefully removed. Sulfanilamide crystals

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Read at the meeting of the Western Section of the American Laryngological, Rhinological and Otological Society, Inc., Portland, Ore., Jan. 31, 1943.

1. Fred, G. B.: Acute Fulminating Osteomyelitis of the Frontal Bone: A Review and a Prediction, Ann. Otol., Rhin. & Laryng. **51**:638 (Sept.) 1942.

2. Jones, A. C.: (*a*) Osteomyelitis of the Frontal Bone, Ann. Otol., Rhin. & Laryng. **45**:726 (Sept.) 1936; (*b*) Osteomyelitis of the Frontal Bone with Report of Thirteen Cases, ibid. **49**:713 (Sept.) 1940.

were dusted into the cavities. A Penrose drain was inserted into the frontal sinus. The external wound was closed completely. The window beneath the inferior turbinate was large, and the lining did not seem to be badly diseased. Nothing further was done to the antrum.

That evening the patient felt well and the administration of sulfathiazole was started again —15 grains (0.97 Gm.) every four hours. The level of sulfathiazole in the blood varied between 10 and 18 milligrams per hundred cubic centimeters. The white blood cell count fluctuated from 13,000 to 6,500 on the eleventh postoperative day. The urine was normal except for a few crystals. On the eleventh day the patient was allowed to go home. There was no external swelling and little scarring. Because of the drop in the white blood cell count the dose of sulfathiazole was diminished to 7½ grains (0.46 Gm.) every four hours. The laboratory reported a mixture of streptococci and staphylococci.

Two days later a few crusts were removed from the right nostril at my office. The white blood cell count was 8,300, and the patient felt well and wanted to know when I was going to operate on the other side. Two days later she telephoned that she felt as though she had the "flu." The glands beneath the angle of her right jaw were tender, and there was a slight swelling over her right cheek. Examination performed later in the day at the office showed a little swelling over the right antrum. A few glands were palpable, and there was some redness of the throat. The patient's temperature was 99.6 F. The next day she felt worse, her temperature was 100.2 F. and the swelling over her antrum was more marked. She expressed the belief that the sulfathiazole was upsetting her stomach. I sent her back to the hospital. The white blood cell count was 14,600, and the level of sulfathiazole in the blood had dropped to 6 mg. per hundred cubic centimeters. I then changed to sulfadiazine, giving her 15 grains (0.97 Gm.) every four hours, and ordered hot applications to be used over her cheek. The swelling increased, and I thought I could feel a definite fluctuation.

On the seventeenth postoperative day I incised the swollen area down to the cheek bone. There was considerable uncovered bone, and about 2 drachms (8 cc.) of pus was discharged. I diagnosed this as a subperiosteal abscess. I irrigated the area with a 2 per cent solution of sulfathiazole sodium sesquihydrate. A small rubber drain was placed in the wound. Irrigation with the solution of sulfathiazole sodium was carried out daily. Twenty-four hours later the patient felt much better. Her temperature was 99 F., and she was able to take sulfadiazine without any gastric disturbance. The wound drained for about fifteen days. The swelling rapidly receded, and she left the hospital on the twenty-fifth day after her second admission. The level of sulfadiazine in the blood fluctuated between 16 and 20 mg. per hundred cubic centimeters. The white blood cell count dropped to 7,000, and for the next five days the doses of sulfadiazine were reduced gradually. Culture of the pus showed nonhemolytic staphylococci. The pain over the right frontal sinus was gone. There was little discharge from the nose, and the patient felt improved except for the fact that she still had a productive cough and some pain over the left frontal sinus. The left nostril was completely closed with polyps, which were bathed in pus.

She was eager to have the other side operated on, but I thought that I had had enough excitement for a while. However, two months after her first operation she stated that she was anxious to have the other side operated on, as all discomfort had gone from the side of her face operated on and she was able to breathe freely through the right nostril for the first time in many years.

She was hospitalized, and sulfadiazine, 15 grains (0.97 Gm.) every four hours, was given for five days before the second operation. The level of sulfadiazine in the blood rose to 16 milligrams per hundred cubic centimeters, and on April 16 the left side was operated on with the region under local anesthesia. The external approach was used. The involvement was more extensive throughout than that on the right side. The left frontal sinus was several times as large as the right one. The floor of this sinus was completely removed. A careful exenteration of the ethmoid and sphenoid cells was performed. The anterior wall of the left sphenoid sinus was resected. The anterior and posterior ethmoid arteries were tied before they were cut. Beneath the left inferior turbinate there was a large opening into the antrum, which contained a few polyps and some thickened lining. This was removed as carefully as possible through the opening underneath the turbinate. After the cavities had been sprinkled with sulfanilamide powder a hard rubber drainage tube was placed in the floor of the left frontal sinus. The external wound was closed completely. The patient's postoperative condition was good. There was no elevation of temperature and no swelling. The daily white blood cell count ran from 6,500 to 9,000; the level of sulfadiazine in the blood varied from 10 to 18 milligrams per hundred cubic centimeters. On the tenth postoperative day she was allowed to leave the hospital, and the dosage of sulfadiazine was gradually reduced. Culture of the pus showed a mixture of organisms. The patient was examined once or twice at the office.

Five days after leaving the hospital she stated that on the evening of the previous day she began to feel ill and had some pain over the left frontal sinus and more postnasal discharge than she had had for some time. Examination showed some swelling over the left frontal sinus, which extended across to the right side, and some edema of both the left upper and the left lower eyelid. The temperature was 100.5 F. The patient was immediately hospitalized. The white blood cell count was 16,000. Administration of sulfadiazine, 15 grains (0.97 Gm.) every three hours, was started. Hot compresses were applied over the forehead. The next day she was sitting up in bed reading and was able to do some fancy work. The swelling had not ascended any higher, but she did not look well to me. I opened both previous wounds, and considerable pus was discharged. Irrigating on one side caused pus and fluid to come out from the other side, which showed that the periosteum was definitely separated from the bone. Irrigation was carried out daily with a 2 per cent solution of sulfathiazole sodium sesquihydrate. The temperature fluctuated from below normal to 101 F. There was not much advancement of swelling over the forehead. However, there was more swelling beneath the left eye. The patient was given six transfusions of citrated blood, one of which caused her temperature to rise to 103.4 F. with a marked chill. Ten grains each of sulfathiazole and sulfathiazine were given every three hours. The level of the drugs in the blood rose to 20 mg. per hundred cubic centimeters. There was no evidence of choked disk in either eye. There was no disturbance in her reflexes, and her mentality was good. She seemed to be considerably depressed, but not more so than the effects of the drugs would warrant.

The patient was not as acutely ill as is one with fulminating osteomyelitis, and she was not as well as one in whom a localized sequestrum is developing. Sometimes I think there is a sixth sense that warns a physician of impending danger. A culture of nonhemolytic staphylococci was obtained. Expert neurologic consultation was not available. Consequently, I advised the patient and her family that I wanted help, and they agreed to go to a clinic where there were a neurologic department and a competent brain surgeon. One of my associates accompanied the patient. The trip was uneventful except that some hardly noticeable mental changes developed in the patient. She complained that her husband did not appreciate her illness, and during the night she climbed from the lower to the upper berth in her stateroom. This change in mentality was not mentioned to the consulting physicians, but I think it had a considerable bearing on the succeeding events. Soon after her arrival at the clinic I received a letter, part of which I will quote:

> "Doctor P. arrived with Mrs. F. on May 21, 1942, and she was immediately seen by me. In view of the fact that the swelling had extended up over the bridge of the frontal bone, we believed it would be wise to make a longitudinal incision which would be carried downward to the frontonasal bone in order to supply adequate drainage and prevent the infection from spreading upward. This I did on May 22. On the advice of the rhinologist I slipped the small-split rubber tube through underneath the tissues so that it communicated with the openings of the inner canthus of both eyes. Mrs. F. has an osteomyelitis, and pus is pouring out in great style in the left maxilla, which suggests that there is an active process going on. For the present we are using hot packs with the hope of localizing the lesion before draining it."

Three days later I received a second letter, which I quote:

> "We have a surprise and shock for you. Mrs. F. was getting along as well as could be expected. Suddenly on Sunday she went into opisthotonos and died. The postmortem examination revealed an abscess of the frontal lobe of moderate size on the right side. In going back over her history, except for the sinus infection and an occasional headache, there were no positive signs of increased intracranial pressure. She had no choked disk and no disturbance in her reflexes, and there was no hemiparesis or hemianesthesia."

A short time later I had a personal conversation at Atlantic City with the neurosurgeon. He assured me that the frontal bone had been removed over the frontal lobe and that there were no granulations on the dura and no evidence of increased intracranial pressure.

CONCLUSIONS

1. I still feel that the sulfonamide compounds are wonderful drugs but that they have their limitations in the treatment of osteomyelitis of the frontal bone.

2. I think that the drugs have a tendency to mask many of the danger signals in osteomyelitis and in other diseases.

3. I believe that osteomyelitis, when definitely diagnosed, demands the radical surgical intervention that I have advocated in my previous papers.

CHRONIC SUPPURATIVE OTITIS MEDIA

A REVISION OF THERAPEUTIC PRACTICE

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Currently available methods for the conservative treatment of chronic otitis media make possible a striking improvement in results. Important advances made in therapeutic agents justify a critical review of the types of treatment. Persons with chronically discharging ears have lowered efficiency and a prognosis of a shorter life span. The national emergency requires that measures be taken for the preservation and restoration of auditory acuity.

Treatment of chronically infected ears with specific indications for surgical intervention constitutes another chapter of therapy.

A group of patients has been chosen to form a basis for the present discussion. They were selected from a larger group observed in private practice and in hospital and university clinics because they presented specific types of lesions of the middle ear. Accurate observations on progress and a precise tabulation of results were possible because of the variety of the lesions represented and the intelligent cooperation of the patients. Certain practical conclusions have been reached.

Babbitt [1] and others have written concerning the conservative treatment of chronic infections of the middle ear. Recent contributions to the literature on therapy have dealt almost exclusively with acute otitis media.

The structures of the middle ear as tiny parts of the body are influenced by its deficiencies and diseases. Successful therapy for many patients requires an understanding of their general nutrition, including possible vitamin deficiencies, allergic reactions and even disturbances of the endocrine glands. Additional laboratory requirements may necessitate determination of the basal metabolic rate, a complete blood count, biochemical studies, urinalysis, roentgenographic study of both temporal bones and, in certain instances, Wassermann and Kahn tests. A general history should include specific mention of previous local therapy. Acquisition of excellent otologic detail, supported by improved therapeutic measures, more firmly establishes local therapy. A fair proportion of chronic disorders of the ear will prove to be local problems.

BACTERIOLOGIC DATA

Fowler [2] reported on cultures of material from the ear in 100 consecutive cases of chronic suppurative otitis media recorded by the Columbia Presbyterian Hospital Center from 1928 to 1938. In most cases the results indicated mixed infections. In 24 cases pure cultures were obtained. In 16 cases material for culture

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1. Babbitt, J. A.: Conservative Treatment in Diseases of the Ear, Ann. Otol., Rhin. & Laryng. **43**:1001, 1934.

2. Fowler, E. P., Jr.: Medicine of the Ear, New York, Thos. Nelson & Sons, 1939.

was also taken from the mastoid at operation. In 10 of these cases the same organism was recorded. The types of bacteria found in pure culture were:

Staphylococcus albus	4
Nonhemolytic Staphylococcus albus	2
Staphylococcus albus haemolyticus	1
Streptococcus haemolyticus	5
Untyped streptococci	1
Bacillus pyocyaneus haemolyticus	3
Untyped Bacillus pyocyaneus	1
Bacillus proteus	3
Pneumococcus type 2	1
Pneumococcus type 14	1
Bacterium alcaligenes	1
Diphtheroids	1
	24

Cultures in my series yielded similar organisms, although most of them revealed mixed infections.

PATHOLOGIC OBSERVATIONS

Chronic suppurative otitis media is of two types: that with suppuration of the tympanic membrane and that with ingrowth of epithelium. Beck [3] recognized the following types of chronic suppurative otitis media: (1) tubal and central perforations; (2) marginal and attic perforations; (3) secondary cholesteatoma formation; (4) syphilitic otitis; (5) tuberculous otitis; (6) otitis due to foreign bodies, with infection; (7) otitis caused by infected neoplasm, and (8) postoperative persistent or recurrent infection.

Polyps are an evidence of chronicity and an indication of destruction of bone. It is dangerous to remove aural polyps or granulations during an acute exacerbation. Less friable granulations indicate destruction of bone. Granulations and polyps may later become organized into firm fibrous tissue. Aural polyps are single or multiple; they may be partially organized and covered by squamous or ciliated epithelium and may assume somewhat the character of fibromas. They may have a broad base or a narrow pedicle and may arise from any denuded surface, such as the margins of small perforations, necrotic ossicles, the promontory (in rare instances), the diseased margin or ring, the tympanic vault or the aditus or even the adjacent bony meatus. They may spring from the walls of the middle ear, the eustachian tube or the walls of the pneumatic spaces in association with disease of bone.

Central perforations are usually in the posterior segment, and occasionally in the anterior, or they may involve both segments in cases of perforations of horseshoe, kidney or heart shape. Marginal perforations occur most frequently and characteristically at the peripheral edge of the upper posterior segment of the pars tensa and the adjacent Shrapnell membrane, which is destroyed, the bony ring to which the membranes were attached being left bare. Perforations in Shrapnell's membrane occur; they may be just above the short process of the malleus, or just above and a little in front of the malleus, and extend back through the posterior striae of Prussak. The ossicles are not necessarily diseased.

The result of a successful epidermized conversion to a grayish white, nonsecreting membrane has some semblance to the skin of the meatus. Conversion

3. Beck, J. C.: Nonsurgical Treatment of Chronic Middle Ear Suppuration Based on Twenty-Five Years of Experience, Ann. Otol., Rhin. & Laryng. **381**:1151, 1929.

of the recesses of the tympanum into a dry cavity is nature's method of limiting spread of the disease. An unsuccessful epidermization results in a secondary cholesteatoma, an ingrowth forming a compact mass of bacteria, epithelial cells and cholesterol crystals, which painlessly enlarges the bony cavity and cannot be expelled through the aditus (case 8).

Only rarely is the drum membrane completely destroyed, the tough peripheral edge, the annulus tendinosus, being very resistant to suppurative disintegration.

The neoplasm which invades the middle ear and its surroundings most frequently is adenocarcinoma, from the eustachian tube or the pharynx. In cases of tuberculosis [4] an early observation is the thick, camphor ice appearance of the tympanic membrane, combined with peripheral vascular injection and profound loss of hearing. Cases of multiple perforations are encountered in sanatorium practice, but in the usual course of otologic practice they are seldom met. Tuberculous otitis media may heal spontaneously or may respond to careful management. Syphilis of the middle ear is usually secondary to accompanying destruction in the mastoid or the pharynx.

PHYSIOLOGIC CONSIDERATIONS

To preserve or to restore hearing, it is necessary to stop destruction of the drum membrane and the middle ear as early and as effectively as possible. Certain physiologic considerations will aid in emphasis of this point.

The tensor tympani and stapedius muscles regulate the position of the ossicles and thus affect the tension of the tympanic membrane and the pressure of the labyrinthine fluid.[5] The compensatory movement of the membrane in the fenestra rotunda is about four times as great as that of the membrane about the foot plate of the stapes in the fenestra ovalis.

The tympanum functions as a resonator that is tuned to every note from 40 to 4,000 vibrations per second with almost equal accuracy. This is made possible by a highly specialized anatomic structure and a rapid damping effect, due to the tensor muscles, the chain of ossicles and the endolymph, which enable one to distinguish about ten notes per second.

Perlman and Case [6] studied the reflex contraction of the stapedius muscle, which arises in response to nerve impulses arising in the cochlea and is transmitted along the reflex pathway. The latent period for the loud tone of 1000 cycles is about 0.0105 second. This latent period, of no protection, accounts for acoustic trauma from explosions and loud noises and emphasizes the function of the stapedius muscle.

The tensor tympani muscle functions as an intensity control, a frequency selector and a tension adjustor for the drum membrane and the ossicles in the transmission of sound.

Experimental tension on the tendon of the tensor tympani muscle increases the rigidity of the ossicular chain and impairs the transmission of all low tones. Division of the tendon results in relaxation of the ossicular chain and rotation of the malleus on its long axis and impairs transmission of high tones. Crowe and associates [7] concluded that impairment of function of the tensor tympani muscle

4. Lederer, F. L.: Clinical Significance of Aural Polyps, Arch. Otolaryng. **33**:1008 (June) 1941.

5. Luciani, L.: Human Physiology: The Sense Organs, translated by Frandes A. Welby, London, Macmillan & Co., 1917, vol. 4.

6. Perlman, H. D., and Case, T. J.: Latent Period of the Crossed Stapedius Reflex in Man, Ann. Otol., Rhin. & Laryng. **48**:663, 1939.

7. Crowe, S. J.; Hughson, W., and Witting, E. G.: Function of the Tensor Tympani Muscle: An Experimental Study, Arch. Otolaryng. **14**:575 (Nov.) 1931.

may be one of the common causes of impairment of hearing for high tones. Prompt and efficient local therapy in the presence of infections will preserve these highly specialized functions and minimize damage.

NEUROLOGIC CONSIDERATIONS

The human ear drum is supplied chiefly by nerves which enter from the external auditory meatus as one trunk passing along with the principal artery; by numerous small peripheral branches, and by fewer branches from the tympanic cavity.[8] The nerve supply comes from the nervus auriculotemporalis, a branch of the mandibular division of the nervus trigeminus, and from the vagus nerve.

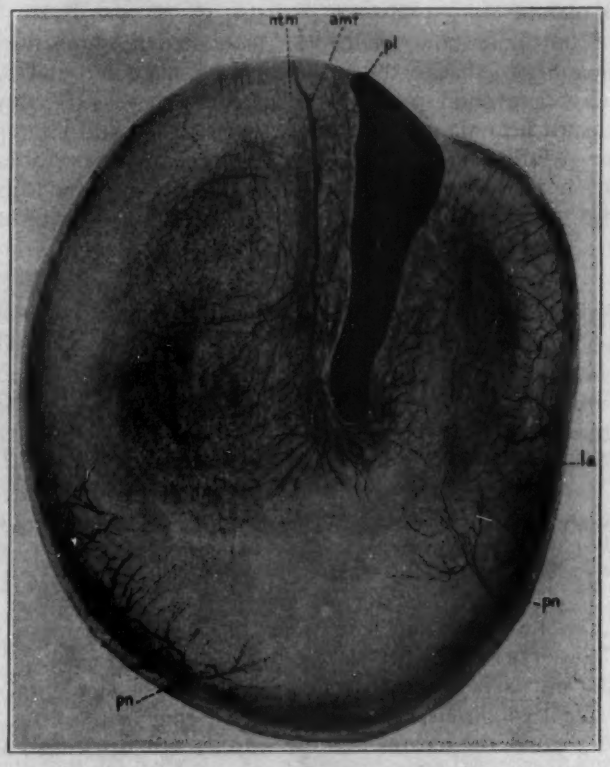

Fig. 1.—Innervation of the human ear drum (from Wilson,[8] plate 1). The main group of fibers enter as one trunk (*ntm*), passing along with the main artery (*amt*). There are, however, numerous small incoming peripheral branches (*pn*). Here, *pl* indicates the processus lateralis of the manubrium; *la*, the limbus membranae tympani anterior, and *pl*, the limbus membranae tympani posterior.

The nerves of the pars tensa enter chiefly from the external auditory meatus either over the pars flaccida or at the limbus. A few fibers pass in directly from the tympanic cavity. The branches coming from the pars flaccida are directed toward the manubrium and reach it as several nerve bundles. These cross the plicae anterior and posterior at various points, toward the manubrium, which they reach along its upper third, the larger bundles crossing over the posterior plica. When the main trunks reach the manubrium, they may continue down one

8. Wilson, J. G.: Nerves and Nerve Endings of the Membrana Tympani of Man, Am. J. Anat. **11**:101, 1910-1911.

side or may divide and send a branch down each side, the two branches being connected by a plexus of fibers across the external surface of the manubrium. From the large nerve bundles branches pass off either to form plexuses over the internal and external surfaces of the manubrium or at intervals to radiate toward the periphery. Each of these, with little or no medullary sheath, is of considerable size near the manubrium, but since at repeated intervals along its course it gives off branches, it finally arrives at the limbus as a very fine fiber. The branches which these radiating nerves give off are mostly nonmedullated; they frequently divide and interlace with each other to form in the membrana propria wide-meshed networks, the ground, or fundamental, plexus. This plexus lies among the circular and radiating connective tissue bundles and connects with the subepithelial and submucous plexuses.[9]

One cannot but note how analogous the distribution of the nerves in the membrana tympani is to that in the cornea. Here, also, is found a zonular plexus (annular plexus); a ground plexus (fundamental plexus), occupying the whole extent of the cornea near the surface, and a subepithelial and interepithelial plexus, with budlike or pointlike endings. One is tempted to carry the analogy further and to say that, as in the cornea, pain, and not touch, appears to be the sensation evoked; so, also, in the membrana tympani one might expect that the slightest

Fig. 2.—Nerves in the membrana tympani of the monkey (from Wilson,[9] fig. 11). Here, *a* is the subepithelial plexus, with nerve endings in the epidermis, and *b*, a nerve branching and interlacing with the subepithelial plexus.

pressure would evoke unpleasant sensations, passing into pain—a fact well borne out by clinical observations.[9]

Herpes zoster oticus, originating from inflammation of a ganglion embryologically similar to the spinal ganglions, is manifested by herpes of the drum membrane, the external auditory canal, the meatus and the auricle, with associated aural symptoms, with or without facial paralysis.[10] The vesicular eruption arising from herpes zoster of the geniculate ganglion is limited to a cone-shaped area, with its apex on the tympanic membrane and its base at the auricle. The facial nerve, essentially motor, has associated with it in the fallopian canal the sensory nerve of Wrisberg, the afferent nerve of the geniculate ganglion. It consists of the chorda tympani nerve and fibers from a well defined area of skin. The latter are incorporated in the auriculotemporal branch of the third division of the fifth cranial nerve and the auricular branch of the vagus nerve, reaching the ganglion through connections with these nerves. Involvements of the herpes type are significant because they have been more frequent during recent years and may produce certain nutritional disturbances of the drum membrane and middle ear, which delay healing and contribute to chronicity.

9. Wilson, J. G.: The Nerves and Nerve-Endings in the Membrana Tympani, J. Comp. Neurol. & Psychol. **17**:459, 1907.

10. Goodell, W.: Herpes Zoster Oticus, Arch. Otolaryng. **14**:822 (Dec.) 1931.

THERAPY

Wound healing is an orderly biologic process, with three important phases: (1) ameboid movement of cells; (2) their mitotic proliferation, and (3) maturation of cells engaged in the fusion of the surfaces of the wound. Infection delays healing because associated enzymes aid to a variable degree in the destruction of tissue. Devitalized tissue furnishes nourishment for further bacterial growth.

Vitamin C is known to play an important role in stimulation of healing.[11] Repair requires first class building materials, without which local care may be of little avail. In suppurative involvement of the middle ear devitalized tissue and retained fluid tend to increase the discharge. Debris, crusts and cholesteatomatous masses must be cleared away and free drainage and exposure of infected regions established. A small catheter through a perforation may make irrigation more efficient. A small perforation may be enlarged to reach diseased recesses. All spaces must be cleaned, a curved applicator being used if necessary. All pathologic tissue, such as granulations and diseased ossicles must be removed. Gentle suction is rarely employed. Careful cleansing is most important. Granulations are cauterized with strong, carefully placed solutions of silver nitrate. In the absence of labyrinthine irritation, severe headaches or involvement of the seventh nerve, local treatment should be persisted in before operation is advised. Epithelial debris in the attic must be completely removed. All contributing pathologic processes must have attention.

Older Methods.—Wet Method: Irrigation is done with solution of sodium bicarbonate or boric acid or with hydrogen peroxide. This is followed by careful sponging out of excess solution. A solution consisting of equal parts of a saturated solution of boric acid and 95 per cent alcohol is instilled one to three times daily. The solution causes pain. A 2 per cent solution of urea is frequently useful.[12] It eliminates odor, causes proteolysis of necrotic tissue and stimulates granulation and epithelization. It causes no irritation of living tissue.

Dry Method: Irrigations to cleanse the ear are forbidden in the belief that moisture lowers tissue resistance and encourages bacterial proliferation. The canal must be thoroughly cleansed by small, dry applicators, the first of which may be slightly moistened with a solution of boric acid, a 1:2,500 solution of metaphen or other mild antiseptic solutions for effectual removal of crusted discharge. Time and patience are required before the middle ear is ready for powder. Sulzberger's iodine and boric acid powders, and others of similar formula, have been the most commonly used and are perhaps the most satisfactory. Potassium perborate or boric acid powder may be helpful. Zinc peroxide has been used but is difficult to remove. Papillary hypertrophy of the mucous membrane of the middle ear will subside when iodine powder in increasing strength is used. A germicide for use in the ear must not destroy cells. Iodine in 1:2,000 concentration kills organisms in infected tissues, affecting only slightly the growth of cells. A 1:1,250 solution of iodine destroys cells. Roentgen, ultraviolet and infra-red rays and high frequency currents have not proved their efficacy. Chromic acid, trichloroacetic acid, magnesium sulfate crystals, subcutaneous injections of protein, picratol (a preparation of silver trinitrophenolate), oxyquinoline tartrate, meroxyl (a mixture containing about 50 per cent of the sodium salt of 2,4-dihydroxy-3,5-dihydroxymercuri-

11. The Healing of Wounds, editorial, Brit. M. J. **1**:560, 1941.

12. Lewy, R. B.: Use of Urea in Diseases of Ear, Nose, and Throat, Arch. Otolaryng. **26**: 195 (Aug.) 1937. Mertins, P. S., Jr.: Use of Urea in the Treatment of Chronic Otitis Media: Preliminary Report, ibid. **26**:509 (Nov.) 1937.

benzophenon-2'-sulfonic acid), acetic acid and diathermy have given slight therapeutic assistance.

When the membrana tympani heals, according to Stinson[13] and other observers,[14] there are definite patterns of proliferation, constituting growth lines or cutaneous currents. I have verified these reports in frequent observations.

1. The epidermis of the tympanic membrane proliferates and migrates from the anterior margin to the posterior wall, following the wall to the meatus. This explains why scars on the drum membrane disappear.

2. The epidermis of the membrana flaccida fans out over the wall of the canal radially from the original focus.

3. Proliferation of epidermis around the short process proceeds in whorls, generally tending to move toward the superior wall.

4. The rate of epithelial movement is more rapid in the posterior inferior quadrant, which makes this location advisable for myringotomy.

5. Proliferation of epithelium from the canal toward the drum membrane has not been observed. This may be a factor in the failure of tubal perforations to close. These five observations are credited to Stinson and are readily verified.

Sulfonamide Compounds.—Dr. Gerhard Domagk's work was done in Germany and made public in 1935. This work was the basis for the more highly effective sulfonamide compounds in use today, which are products of research successfully culminated by American chemists. Much has been written concerning their value in treatment of acute otitis media, but little emphasis has been placed on their great value in local therapy of chronic otitis media.

Mayo and Miller[15] pointed out the value of sulfanilamide and azosulfamide when applied to infected or exposed wounds. They used azosulfamide locally and applied sulfanilamide as an 0.8 per cent solution, as a suspension and as a powder by insufflation. The suspension is made by adding 30 grains (1.95 Gm.) of powdered sulfanilamide to 100 cc. of isotonic solution of sodium chloride. The 0.8 per cent solution is also prepared in isotonic solution of sodium chloride. Two factors are necessary for optimum results: (1) The organisms must be brought in contact with a sufficient concentration of the drug to produce optimal bacteriostasis, and (2) the normal defense mechanism of the body must be active.

Sulfanilamide became generally available in 1937, sulfapyridine in 1939, sulfathiazole in 1940 and sulfadiazine and sulfaguanidine in 1941. As these substances have become available, they have been tried locally in treatment of chronic suppuration of the middle ear. Many patients previously treated by application of tinctures of mercury, silver nitrate and iodine powders and by other long-continued local measures have been cured. Others have shown striking improvement. Improved therapy of acute otitis media will reduce the number of cases of chronic suppurating ears, but these will still appear in considerable numbers in private practice and in the clinics.

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13. Stinson, W. D.: Reparative Processes in the Membrana Tympani: Some Interesting Manifestations, Arch. Otolaryng. **24**:600 (Nov.) 1936.

14. Magnoni, A.: Migration of Epithelium of the Drum Membrane, Valsalva **14**:234, 1938.

15. Mayo, C. W., and Miller, J. M.: Solution of Sulfanilamide in the Local Treatment of Wounds, Proc. Staff Meet., Mayo Clin. **15**:609, 1940.

Jacoby, Medawar and Willmer,[16] after a study of the effects of sulfonamide compounds on cells in vitro, submitted the following conclusions to the War Wounds Committee of the Medical Research Council of Great Britain:

1. In equal concentrations sulfathiazole is the most toxic of these compounds.

2. The effective toxicity of the sulfonamide compounds under clinical conditions is determined by their relative solubilities, which decrease in the following order: sulfanilamide, sulfathiazole, sulfapyridine, sulfadiazine and sulfaguanidine.

3. The inhibitions of growth and unfavorable morphologic effects of the highest concentrations of sulfathiazole are followed by complete recovery when the drug is removed.

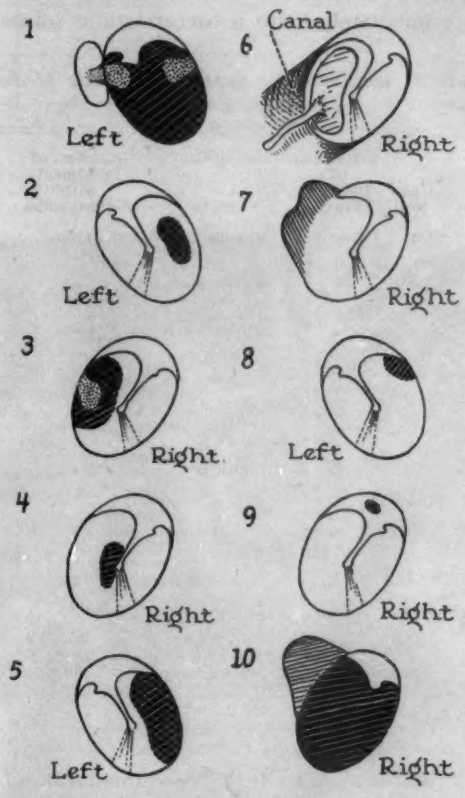

Fig. 3.—Types of defects in the tympanic membrane and pathologic processes in the middle ear of 10 patients with chronic suppurative otitis media.

4. There is a profound difference between bacteriologically effective concentrations and those appreciably toxic to cells.

5. Clinically, the relatively specific bactericidal power of these compounds should outweigh other considerations.

6. The evidence from tissue cultivation is that in the choice of a sulfonamide compound for direct application to wounds the relative effect on tissues can be disregarded in favor of their relative specific bactericidal power.

7. There is no evidence in vitro that the drugs accelerate growth.

16. Jacoby, F.; Medawar, P. B., and Willmer, E. N.: The Toxicity of Sulfonamide Drugs to Cells in Vitro: A Report to the War Wounds Committee, Brit. M. J. 2:149, 1941.

There is some virtue in one's suiting the sulfonamide compound to the bacteria present in the middle ear. However, because of the higher solubility of sulfanilamide, this compound has been found more generally useful, very effective and economical. I have employed the 0.8 per cent solution, the suspension and the powder. The 0.8 per cent solution is prepared in distilled water and in solution of sodium chloride and is kept fresh. I have largely discontinued the use of these solutions in favor of a suspension of sulfanilamide in distilled water, 1 Gm. in 30 cc. Patients are instructed to shake the bottle and carry some of the suspended crystals in the dropper for transfer to the cavity of the middle ear. The ear should be frequently inspected so that too great a quantity of crystals does not accumulate. I have found it of great advantage to have some crystals always in the middle ear because secretions immediately form a bacteriostatic solution and there are no

Data on Ten Patients with Chronic Suppurative Otitis Media Treated with Sulfonamide Compounds

Patient	Age, Years	Case No.	Duration of Disease, Years	Origin	Duration of Treatment with Sulfonamides	Result
E. H.	41	1	15	Measles	14 mo.	Gradual epithelization; no new granulations
J. N.	72	2	66	Scarlet fever	7 wk.	Closure of drum membrane; restored hearing
D. H.	11	3	5	Scarlet fever	8 wk.	Dry, healthy epithelization
J. K.	12	4	4	Measles	4 wk.	Dry, unhealed perforation
T. S.	9	5	3	Perforating injury	12 wk.	Dry, smooth cavity
M. R.	48	6	20	Influenza	16 wk.	Closure with epithelial tube, which persisted three months
D. M.	32	7	10	Scarlet fever	3 mo.	Clean; no granulations; healthy epithelization
E. A.	58	8	23	Pneumonia	2 yr.	Quiescent
V. C.	52	9	¾	Influenza	4 wk.	Complete closure; restored hearing; normal ossicles
T. S.	47	10	11	Scarlet fever	2 yr.	Usually dry; no granulations; moderate secondary cholesteatoma

intervals of recurrent bacterial activity. New membranes form rapidly in the presence of moisture and bacteriostasis. Microcrystals of sulfathiazole can be prepared by crystallization of the drug as it is violently agitated by sonic vibration. A saline suspension of the crystals so formed may be made. Their fineness apparently permits a more rapid rate of solution than that of the usual powder. It is effective against a wider range of organisms. Alertness on the part of the otologist, with thorough cleansing of the ear, local use of sulfonamide compounds, as suggested, and complete cooperation of the patient give hitherto unachievable results. Coincidental oral administration of the drug seems seldom to be of benefit. There need be no concern about toxic effects or concentrations in the blood in local therapy because the amounts of the drugs so used are small.

Figure 3 presents diagrams for 10 patients selected for the type of defect in the drum membrane and the pathologic process in the middle ear. The data on these patients and the results of therapy are given in the accompanying table, and their cases are briefly summarized in the following portion of the text.

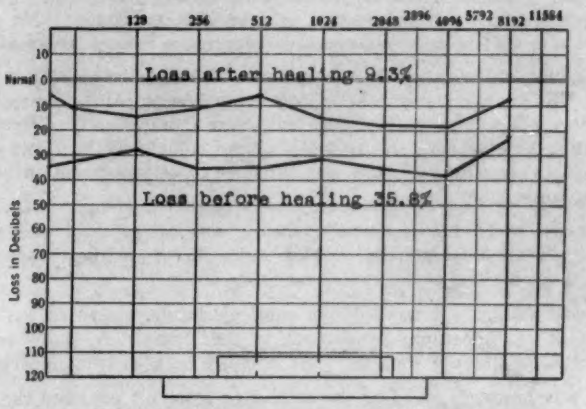

Fig. 4.—Audiogram for patient 2.

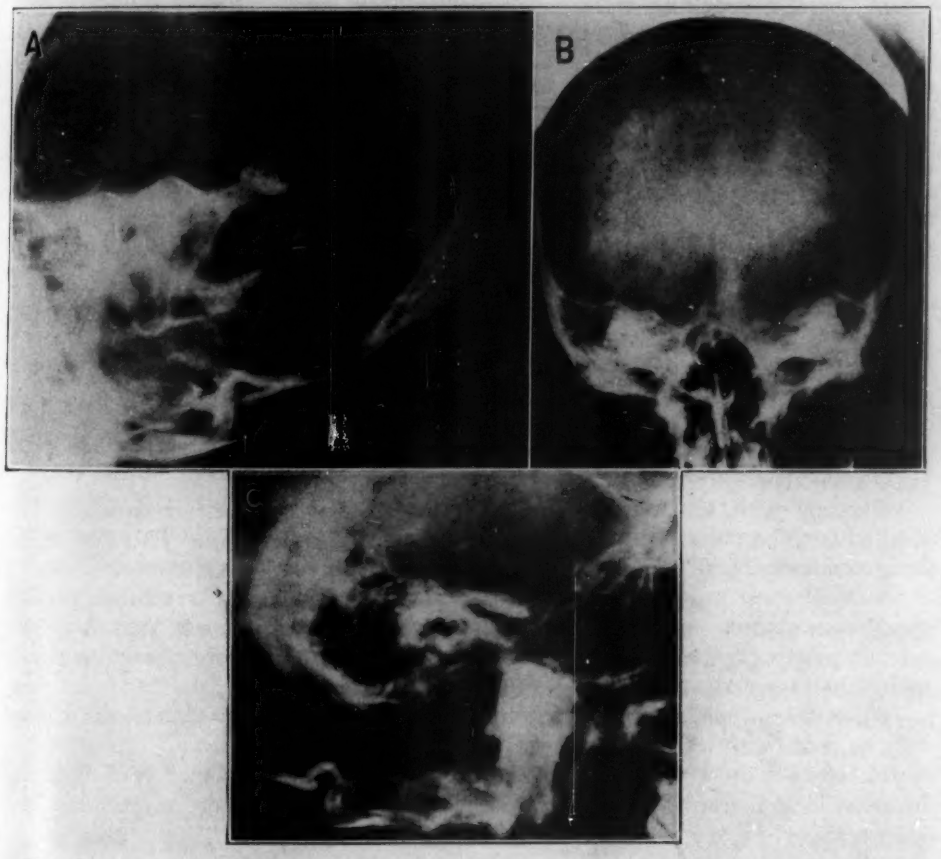

Fig. 5.—*A*, erosion of the left mastoid by a cholesteatoma; *B*, roentgenogram showing eroded cavity in the left mastoid (at right) filled with epithelial debris, and *C*, normal right mastoid.

CASE 1.—E. H. had moderate secondary cholesteatoma formation. All evidence of disease of the bone, including granulations, disappeared with therapy with sulfonamide compounds. Healing has been uninterrupted and progressive, with good epithelization. No other therapeutic routine had given results that in any way equaled the present rate of progress.

CASE 2.—J. N. had had a perforated drum membrane with reduced hearing in the left ear since the age of 6 years. During the last winter season, while the patient was bathing in the ocean, the ear became acutely infected. The moist bacteriostatic therapy with sulfonamide compounds enabled the perforation to granulate slowly and to close completely an ovoid defect measuring 3 cm., of sixty-six years' duration. There was satisfactory improvement in hearing, as shown in the accompanying audiogram (fig. 4).

CASE 3.—In the case of D. H., as a trial measure, surgical removal of a large granulating mass was postponed. The mass gradually receded under therapy with a suspension of a sulfonamide compound, and the ear has been dry for many weeks.

CASE 4.—J. K. was promptly relieved of the aural discharge, but there has been no tendency for the perforation to close because of contact at the umbo. A small perforation at the manubrium failed to close because the epidermis doubled back on the underlying structures.

CASE 5.—T. S. was promptly freed of the discharge from his ear, and the cavity is becoming epithelized. As with epithelial repair of the drum membrane, epithelization of the middle ear cavity is much more rapid under bacteriostatic conditions.

CASE 6.—M. R. exhibited the largest perforation which I observed to heal completely. The strange epithelial tube, of 0.5 mm. diameter, persisted three months. It then disappeared, with final complete closure and excellent improvement in hearing.

CASE 7.—D. M. has had a long period of suppuration in the middle ear following a radical mastoidectomy. The cavity is easily kept dry with the occasional use of suspension of sulfanilamide.

CASE 8.—E. A. had an innocent-appearing marginal perforation, measuring 2 mm. Roentgenographic study (fig. 5) revealed advanced cholesteatomatous destruction of the left mastoid; this lesion explains why local and systemic use of sulfonamide compounds was of no avail during a period of activation of the process.

CASE 9.—V. C. exhibited a perforation in Shrapnell's membrane, which closed, with apparent complete sterilization and without continued disease of the ossicles.

CASE 10.—T. S. had facial scars resulting from scrofula. The drum membrane was entirely missing, and there was moderate secondary cholesteatoma formation. Occasional use of a suspension of sulfanilamide keeps the cavity in excellent condition.

CONCLUSIONS

Greater therapeutic progress can be made with sulfonamide compounds than with any other currently available local therapy.

Therapy with sulfonamide compounds as advised is a wet treatment. This method is to be preferred when bacteriostasis can be maintained. This can readily be accomplished by the use of a suspension of the sulfonamide substance.

Sulfanilamide generally is to be preferred because its greater solubility makes possible a greater concentration. A suspension of sulfathiazole may have the advantage of a greater range of bacteriostasis. The suspension of crystals adequately maintains bacteriostasis and allows uninterrupted healing.

All of the principles of cleansing must be observed in order that proper contact may be made with infected regions.

Results are most striking when there is no epithelial invasion. With epithelial invasion local therapy with sulfonamide compounds gives better results than have been achieved by any previous therapeutic agents.

636 Church Street.

SECRETORY OTITIS MEDIA

ILLUSTRATED WITH PHOTOGRAPHS OF THE TYMPANIC MEMBRANE IN NATURAL COLOR

CAPTAIN IRVIN HANTMAN
MEDICAL CORPS, ARMY OF THE UNITED STATES

The symptom complex of secretory otitis media with the presence of fluid in the middle ear cavity is a common, although apparently a frequently overlooked, condition and needs reemphasis at this time, especially with regard to diagnosis and treatment. Because of the war emergency, large numbers of men have been quickly mobilized in the Armed Forces, and many of these are leading a predominantly outdoor life under conditions different from those to which they have been accustomed. An increase of respiratory diseases is inevitable under these circumstances, and inasmuch as secretory otitis media is most often secondary to a mild infection of the upper respiratory tract, it is being more frequently encountered. In the months of January, February, March and part of April of 1943 in the Ear, Nose and Throat and Flight Surgeon Services of Keesler Field Station Hospital, 76 men with fluid in the middle ear were seen, and undoubtedly this condition is occurring as frequently in other military establishments. There is, too, no doubt that many cases of this type are being overlooked. This may be due in part to the failure of the otologist to be on the lookout for them and, further, unavoidably perhaps, to the fact that men are being shifted quickly from one post to another and may either neglect to apply for treatment or not remain under observation long enough to receive the otologic treatment indicated.

Inasmuch as it is generally felt that untreated or recurrent secretory otitis media is one of the most common causes of chronic catarrhal or chronic adhesive middle ear disease,[1] associated with loss of hearing, it is important that Army physicians, especially, become familiar with this disease and the most effective methods of treatment.

It is not planned to dwell on the etiologic and pathologic phases of this subject. Most investigators feel that secretory otitis media, also called by such various names as "seromucous middle ear catarrh," "exudative middle ear catarrh," "serous otitis media," "hydrotympanum," "secretory middle ear catarrh," [2] is due to a low grade or hypovirulent infection of the eustachian tube and middle ear,[1] most often occurring secondary to mild rhinitis, catarrhal sinusitis or infection of the nasopharynx. Frequently no history of any respiratory infection can be elicited, although there may have been such an infection with symptoms too mild to impress themselves on the patient. Robison [2] expressed the belief that there is definitely also a clinical entity of

From the Ear, Nose and Throat, and Flight Surgeon Services, Station Hospital, Keesler Field, Miss.

This study was conducted under the direction and guidance of Major S. S. Hall, M. C., chief of the Ear, Nose and Throat Service. Assistance was given by Major Hall, Major L. K. Tester, M. C., and First Lieutenant G. Rose, M. C., of the Ear, Nose and Throat Service.

1. Lederer, F. L.: Diseases of the Ear, Nose and Throat, Philadelphia, F. A. Davis Company, 1938.

2. Robison, J. M.: Subacute Catarrhal Otitis Media and Mastoiditis with Effusion, South. M. J. **35**:815, 1942.

effusion in the middle ear that would "seem to be due to an idiopathic closure of the eustachian tube." Allergic states of the nose and nasopharynx seem to play an etiologic role in some cases.[3]

The pathologic changes, it is agreed, are caused by the closing off of the eustachian tube as a result of swelling of the mucous membrane or of obstruction at the pharyngeal orifice, with formation of either a transudate, owing to the osmotic action of the negative pressure on the blood vessels of the middle ear cavity and eustachian tube ("ex vacuo"),[1] or both a transudate and an exudate, the latter produced by a low grade infection, as Schlander and Goebel concluded after chemical examination of the albuminous content of the fluid.[4] This secretion may be rich in neutrophils,[5] but many investigators have found that the secretion is usually sterile,[6] bacteriologically negative. Löwy [5] discussed the character of this fluid at great length. He found that by testing the middle ear secretion with the erythrocytes of known blood groups (in 15 cases) he was able to determine the blood group of the secretion even in 1:8 dilution. Hence he is convinced that the secretion is a transudate.

Ours is a ground echelon of the Air Force, and as our experience is limited, we cannot draw conclusions as to the relationship of flight to this disease. Two of our patients, however, gave a history of flying just before the occurrence of the stopped-up feeling in the ear. There was neither pain nor any alteration of the tympanic membrane typical of acute aero-otitis media, so we felt justified in classifying their otitis media as the secretory type.

It is interesting to attempt to draw an analogy between secretory otitis media and acute aero-otitis media. In both conditions the drum head is retracted, the eustachian tube obstructed and fluid present. It is my feeling that acute aero-otitis can be considered as sudden hyperacute secretory otitis in which the pathologic changes are caused by the increasing atmospheric pressure of descent acting on a "flutter valve" eustachian tube [7] in such a way as to literally "tear out" fluid—either serous fluid, serosanguinous fluid or actual blood—from the blood vessels of the closed-off tympanic cavity by intense negative pressure. Hence there are pain, acute hyperemia of the drum head with ecchymosis, retraction, formation of fluid and deafness. In secretory otitis the process is more gradual, with obstruction of the eustachian tube by mild inflammation and edema. Suction on the vessels of the tympanum because of mild negative pressure results in serous exudation or in mucoid secretion by stimulation of the mucous glands.[8] Resolution tends to occur more readily in the aero-otitis, if this is not too severe, than in the secretory form, for when the patient returns to the ground the pressure differentials tend to equalize themselves and after a suitable interval the tube opens. In secretory otitis, however, the underlying causative factors discourage spontaneous remission. Hence paracentesis is

3. Ballenger, W. L., and Ballenger, H. C.: Diseases of the Nose, Throat and Ear, Philadelphia, Lea & Febiger, 1938.

4. Jones, C. C.: Acute Catarrhal Otitis Media, Tr. Am. Laryng., Rhin. & Otol. Soc. **46**:379, 1940.

5. Löwy, K.: Concerning the Pathology of Secretory Otitis Media, Monatschr. f. Ohrenh. **72**:40, 1938.

6. Forschner: So-Called Secretory Middle Ear Catarrh, Ztschr. f. Hals-, Nasen- u. Ohrenh. **12**:477, 1925. Jones.[4]

7. Campbell, P. A.: Otolaryngological Problems of Aviation in World War II, Ann. Otol., Rhin. & Laryng. **51**:293, 1942.

8. Lawson, L. J.: Secretory Otitis Media with Special Reference to the Mucous Type, Arch. Otolaryng. **6**:346 (Oct.) 1927.

usually not necessary in aero-otitis and is even considered contraindicated,[7] while it is commonly employed in the secretory form.

Trauma may have played a part in a certain case in our series. Immediately after a blow across the ear, the tympanic membrane was seen to be contused and ecchymotic, and the whispered voice test revealed hearing to be decreased to 1/30 (normal, Army standard, 15/15). Three days later fluid was noted in the middle ear. Resolution was spontaneous, and it is debatable whether the fluid was caused by the trauma or was merely coincidental.

The influence of the weather may be an important etiologic factor. The Ballengers [8] stated that diseases of the upper respiratory tract and middle ear are more common in temperate zones with variable climate and where hygroscopic conditions of the atmosphere exist. In the Gulf Coast area, where our field is located, the weather is exceedingly humid. In the month of January at 8 a. m., for instance, there is an average relative humidity of 86 per cent,[9] which is 10 to 20 per cent more than is usually encountered in the interior of the country.

SYMPTOMATOLOGY

In the majority of cases the symptom complex follows a fairly consistent pattern. The patient has, or recently has had, a nasal cold or a sore throat. One or both ears feel stuffy or blocked, and he generally complains bitterly of impaired hearing in the involved ear. Some of the terms used by patients to describe their feeling are: "ear feels dead or lifeless," "like a piece of wood," "stuffy," "blocked," "hearing lopsided in that ear," "feel something rolling in the ear, like water," "feels like I am speaking through that ear." Tinnitus of various types may be complained of, and occasionally vertigo is present.

If only a small amount of fluid is present, hearing may be little or not at all affected. In 8 cases of our series there were no complaints; the patients were picked up only on routine examinations given them for aerial combat crew. Only on close questioning did these patients admit slight stuffiness of an ear. However, in most cases deafness is markedly distressing and is the presenting symptom. It is this symptom of deafness which seems out of proportion to the length of time of the symptoms and to the apparent pathologic change that should lead one to suspect the diagnosis. Hearing loss as measured by the whispered voice and with use of the Army standard of 15/15 as normal may fall to as low as 1/15 or less, although usually the loss is about 6/15. When measured by the audiometer under ordinary conditions of a clinic, in a quiet room, an average of 30 decibels of loss is found if the ear contains a great deal of fluid (see audiograms 1, 2, 3 and 4 in figure 3). This loss tends to involve the high tones more than the low. It is somewhat surprising that this loss on the audiometric scale represented such depressed whispered voice values as 1/15 to 6/15. Deafness is sometimes so marked that it is difficult to visualize it as due purely to a conductive lesion, and in fact it has been thought that the pathologic process does not stop in the middle ear but extends into the internal ear in the form of edema.[10] The fact, however, that myringotomy and evacuation of the secretion immediately and almost miraculously improve hearing renders this untenable. Löwy,[10] in discussing this hearing loss, expressed the belief that it is due to the incompressible fluid causing increased tension around

9. Climate and Man: 1941 Yearbook of Agriculture, United States Department of Agriculture, 1941, pp. 731-735.

10. Löwy, K.: The Impairment of Hearing During Secretory Otitis Media, Monatschr. f. Ohrenh. **72**:976, 1938.

the foramen rotundum. This would seem to be true, as on occasions I have found that if the head is lowered to an almost upside down position, the hearing improves; it is assumed that the fluid by gravity moves away from the vicinity of the round window.

The symptom of aural blockage may have been present for periods varying from one day to six months or even several years. In the majority of our patients symptoms were present for periods of from two days to two weeks, although complaints of six to ten weeks' duration were fairly common. If pain has been present, it is our experience that it takes about forty-eight to seventy-two hours for the fluid to form after the initial experience of pain. In the cases of long duration, the symptoms are sometimes intermittent, and the blocked feeling may disappear for short periods. Sometimes this feeling of relief may be present at various parts of the day. One patient stated that the blockage and deafness had been present for two years with only short intervals of relief (case 3).

I wish to reemphasize the importance of the symptom of deafness in the diagnosis of this infection. In several instances in which the patient complained of annoying deafness, we were not able to discover fluid at first, even though we strongly suspected its presence. Invariably, however, on observing the drum head after a few days we were able to demonstrate its presence. In reiteration—if deafness seems to be out of proportion to the apparent pathologic change, fluid should be assiduously sought and invariably will be found.

According to Löwy,[5] the cells of the mastoid process are practically always filled with exudate and on the roentgenogram there may be a shading of the whole pneumatic system. In 4 cases in our series in which roentgenograms of the mastoid process were taken, increased density was observed; it could not be stated definitely that this represented fluid.

Our series showed equal incidence of secretory otitis media in the two ears: 26 for the right ear and 27 for the left. In 23 cases, or 30 per cent, the condition was bilateral. In the bilateral type, both ears may not begin to be involved or may not be involved simultaneously. Usually two to five days may elapse before the second ear becomes involved; or one ear may be treated and the condition subside and then the other ear show symptoms.

It is interesting that in the bilateral type of involvement each ear may present a different type of infection. For instance, one ear may be the site of acute catarrhal otitis media with marked inflammation and hyperemia of the drum head, while the other ear may present the secretory form. In an interesting case we discovered acute suppurative otitis media in one ear and secretory otitis media in the other. The sinuses were markedly purulent, and several antral lavages had to be done. Curiously enough, the secretory infection went on to suppuration and ultimately resulted in surgical mastoiditis, while the process in the other ear subsided. In only 2 other cases in our series did secretory otitis advance to suppuration. In both cases it was mild and resolved spontaneously. This parallels the experience of Löwy, who found suppuration in only 2 of 60 patients.[5] This low incidence of suppuration points to the hypovirulence of the disease.

Occasionally, following suppurative otitis media, when the disease is undergoing resolution and the drum head has regained its normal landmarks a secretory phase will develop and fluid will form in the middle ear. This was noted in 2 of our cases.

Pain, in general, is not a marked feature of secretory otitis, and when it is present, it is comparatively mild and rarely lasts more than six to eight hours. This symptom occurred in 12 of our cases at the beginning of the complex, but in every

case it soon subsided. Inasmuch as pain is not a prominent feature of this infection one may conjecture whether in the cases in which it occurs it represents mild acute catarrhal otitis media in an early phase, resulting in the secretory form at a later stage. Some of those patients whom we saw at the time the symptom of pain was present and whose otitis was diagnosed as acute catarrhal otitis presented fluid in the middle ear later. Thus, in acute catarrhal otitis media in which the pain and inflammation of the drum head have subsided but marked hearing loss still persists, fluid should be suspected.

The peculiar characteristic of secretory otitis media in some instances is its insidiousness, such that it must be considered a subacute and sometimes a chronic infection. An interesting phenomenon is the length of time—up to many months—that the secretion can remain in the middle ear with apparently no change. However, it is inevitable that if the secretion is allowed to remain indefinitely, the disease will go on to permanent intratympanic changes with permanent decrease in hearing acuity.

The following cases illustrate this tendency of secretion to remain in the middle ear:

CASE 1.—F. W. W. had been in the Army three and a half months. About three months prior to examination he had an acute sore throat and cold. Since then the ears had felt full and hearing had steadily decreased. He did not seek medical care, as he thought his condition was due to wax. The case was picked up on routine aural examination, at which time both drum heads showed marked retraction and presented peculiar brownish pink coloration. The articulation of the incus and the stapes was unusually prominent. No fluid levels were seen, but experience convinced us that fluid was present. Hearing as tested by the whispered voice was, in the right ear, 1/30 and, in the left, 1/15. Inflation of the eustachian tube rendered a fluid level visible in each ear, and bilateral myringotomy was performed. Profuse amounts of thick mucoid secretion were obtained by second inflation, and the hearing in both ears improved to 15/15, where it remained.

CASE 2.—C. T. complained of deafness of six months' duration in the right ear. The right drum was markedly retracted, and a concave fluid level appeared high in the form of a segmented meniscus with a segment anterior and another posterior, joined at the handle of the malleus. These levels were "frozen," and no motion of the fluid could be observed even after inflation. However, hearing was 4/15, and fluid was definitely suspected, so that paracentesis and inflation were done and a thick mucoid secretion obtained. Hearing improved to 15/15.

CASE 3.—F. R. complained of the right ear being hard of hearing for two years with occasional short periods of relief. The drum head was retracted, and there were bubbles in the middle ear. Hearing was 6/15. Myringotomy and inflation produced a profuse amount of mucoid secretion, after which hearing was 15/15. In this case catheterization and inflation had to be repeated several times before hearing remained normal.

These 3 cases also illustrate, in my opinion, neglected secretory otitis media which might have gone into irreversible deafness if the disease had not been recognized and proper treatment instituted.

Patients who have been hard of hearing previously, either because of a conductive or a perceptive lesion, are of course not immune to the secretory type of infection. These especially complain of the added loss of hearing that occurs. Here, obviously, it is particularly important that proper and prompt therapy be instituted in order to conserve all possible hearing. One of our patients had been hard of hearing since childhood. His hearing at best was only 3/15 in the right and 4/15 in the left ear, the fluid reducing it to 2/15 and 1/30 respectively. This further loss was clearly noticeable to the patient, and he was extremely concerned. (Audiogram in figure 3 shows progress of the left ear.)

APPEARANCE OF THE DRUM HEAD

The typical tympanic membrane picture of secretory otitis media in our experience is not one of increased intratympanic pressure or bulging but one of retraction of the drum head despite the presence of fluid in the middle ear. This is not surprising when the usual pathologic process is considered with the blockage of the eustachian tube and the resultant negative pressure within the tympanum. In only a single case did we encounter bulging of the tympanic membrane due to pressure of the contained fluid. In most cases, particularly those of short duration, if no serious previous pathologic condition has been present, the tympanic membrane looks remarkably thin and almost transparent. The entire membrane is retracted, the light reflex is dispersed, the short process is prominent and quite often the articulation of the long crus of the incus with the stapes is easily made out. In the posterior inferior quadrant the promontory is often visible, and the drum head may be in such close contact with this structure that in performing myringotomy it is sometimes necessary virtually to pull the drum head off the promontory in order to make the incision. In other cases, particularly if an examination is made early, before fluid has formed, the drum head is dull grayish, lusterless and slightly hyperemic. In 2 patients with deafness of long duration we discovered marked atrophy and flaccidity of the tympanic membrane with such marked retraction that the membrane lay as if draped flat up against the inner wall of the middle ear cavity. The joint of incus and stapes, the promontory and the manubrium stood out in sharp relief and detail. Löwy [5] also described a condition of this type and considered it a direct transition to the chronic adhesive process.

The color of the tympanic membrane is often diagnostic. If the drum has not been thickened or scarred, the contained fluid imparts a delicate brownish pink or sometimes a dark tan appearance to that portion of the membrane contiguous with the fluid, while the air-filled portion of the drum may have the normal pearl-like luster. If the entire cavity is filled with fluid, the entire membrane exhibits this brownish pink color. In many cases in which the ivory white promontory shines through the brownish liquid portion, it imparts a canary yellow tinge to that portion of the membrane.

In patients in whom the drum head is more translucent than usual, the fluid instead of being clear may be grayish. One case with this picture was observed in which the grayish color later disappeared and the secretion became clear and transparent.

The types of fluid level are many and varied, depending on the amounts of fluid and air and the degree of retraction present at the time the examination is made. Only in a few cases can the straight or slightly wavy line of fluid (so-called niveau) be seen inferiorly as so often described. If one remembers that with retraction of the tympanic membrane the distance between it and the medial wall of the middle ear is so reduced as to be almost a capillary space, one easily appreciates that the viscosity of the contained fluid may be such that its upper level will be in the form of a meniscus. This meniscus may be single, but more often it is composed of two or more continuous segments. Particularly is this true if the fluid is sufficient in quantity to be at or above the level of the umbo, where the drum head is most concave; in this case the manubrium serves to interrupt the continuity of the meniscus and to form segments as mentioned, so that one segment is anterior and another, which in turn may be further segmented, posterior (fig. 1). When two segments are present, the inner limb of each is joined at the same level at the handle, but the peripheral ends may be at entirely different levels. Occasionally one may find a C-shaped fluid level surrounding the umbo (fig. 1).

If the tympanic cavity contains a fairly large amount of fluid, there may be no fluid level, but a bubble may be discernible, marginally situated, in either the superior-posterior or the superior-anterior quadrant (fig. 1). There it will be noted that on movement of the head the bubble moves exactly like that in the "spirit level" of the carpenter, opposite, of course, to the direction of motion of the head. In other cases bubbles may be seen scattered throughout the tympanum, particularly if the patient has recently used the Valsalva method of inflating the ear, which patients often do to obtain relief (fig. 1).

The motion of the fluid in the middle ear varies with the amount of air in the tympanic cavity and the viscosity of the secretion. When the secretion completely fills the cavity, no motion of fluid can be observed, and air must be introduced through the eustachian tube before motion of the fluid level can be demonstrated. If the secretion is thin and of serous consistency, motion will be more perceptible than if it is thick and mucoid. One case with a six months' duration was observed in which a fluid level in the form of a segmented meniscus was present but was

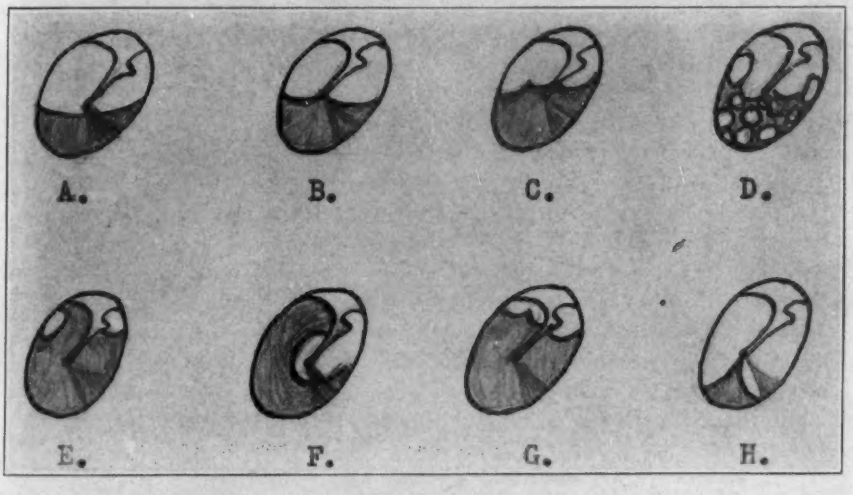

Fig. 1.—Diagrams showing various types of fluid levels:

A, straight or slightly curved level inferiorly.

B, anterior and posterior menisci interrupted by the manubrium—a common type. The posterior meniscus is often somewhat indistinct.

C, segmented posterior meniscus.

D, bubbles scattered throughout drum cavity.

E, drum cavity almost completely filled with fluid. The bubble at the superior-posterior margin moves like that in the "spirit level" of the carpenter.

F, C-shaped meniscus surrounding the umbo—occasionally seen.

G, fluid level high in cavity. The posterior meniscus is segmented.

H, small quantity of fluid present; sometimes looking like a "chevron."

"frozen" because of the thickness of the exudate, and no movement could be demonstrated even after inflation (case 2). A thick mucoid secretion was obtained after paracentesis. Again, even thin serous fluid may be entrapped locally in any portion of the drum, perhaps because of a fold of mucous membrane, and here also no motion can be observed. In general, the more air present the more easily motion of the contained fluid can be demonstrated, and in suspicious cases inflation should be performed. As a matter of fact, as will be pointed out later, inflation

should be resorted to in every case, as it makes the diagnosis more apparent; on auscultation of the ear during catheteral inflation the characteristic bubbling sound of air entering a fluid mass may be heard.

I have been successful in photographing several of these tympanic membranes in natural color, using the technic previously described by me[11] (fig. 2).

TREATMENT

In all cases it is necessary to treat the nasopharyngeal condition underlying the blocked ear. Any acute process in the nose, the sinuses or the nasopharynx should be treated by the usual therapy, including shrinkage of the nasal mucosa and of that of the orifice of the eustachian tube, and careful suction by cannula to remove secretions from the nose and the nasopharynx. Any instrumentation should be avoided during the acute stage.

In general it may be stated that if only a small amount of fluid is present and the hearing is 12/15 or more, resolution may be spontaneous with the institution of proper nasal hygiene. Certain other cases need only one or two catheteral inflations. These cases, however, are in the minority. In the great majority the quickest and safest way of treating this disease after simple procedures have failed is, we feel, by paracentesis of the drum head followed by inflation to drive out the contained secretion. Particularly is this true if the process has been present for any length of time and it is obvious that resolution will not be spontaneous. While it is true that many otologists have a natural reluctance to make an incision of a tympanic membrane which is not particularly inflamed, we have never noted any ill effects from this procedure. A sweeping incision need not be made; one just slightly longer than a stab wound is sufficient. This should be followed in all cases by either suction of the secretion through the incision or inflation of the middle ear, preferably through a eustachian catheter. We have found inflation much more efficient. All catheterizations should be very carefully done to avoid trauma to the orifice of the eustachian tube. If a nasopharyngoscope is available, direct visualization of the catheter movement through it is ideal. If preferred, or if the catheter is not available, politzerization using a minimum of pressure may be carried out. There is seldom any bleeding, and healing occurs quickly, the myringotomy wound closing within forty-eight hours. Anesthesia is not a problem. We have noted, as has Jones,[4] that the uninflamed tympanic membrane can be incised without anesthesia with only slight discomfort to the patient, and many drum heads have been opened by us in this manner. If necessary, the popular cocaine, menthol and phenol mixture can be carefully applied locally to the posterior-inferior portion of the drum head for about five minutes. The nose and the orifice of the eustachian tube should first be prepared by shrinkage, suction and cocaine spray, so that inflation through the catheter can be resorted to following the myringotomy. Our usual routine is to do a preliminary inflation to confirm the diagnosis more definitely, as the fluid level is made much more apparent.

The results of paracentesis and inflation are usually remarkable and even startling. Immediately afterward, the patient exclaims that he hears very well, and on testing the hearing one finds it to be normal or definitely improved by audiogram (fig. 3), and the whispered voice may now be heard at 15 feet (4.5 meters).

The fluid from the middle ear which collects in the canal is removed by cotton wipes. The volume of fluid present may vary from 5 to 15 drops. In many cases

11. Hantman, I.: A Simple Technic for Photography of the Drum-Head, Arch. Otolaryng. **34**:7 (July) 1941.

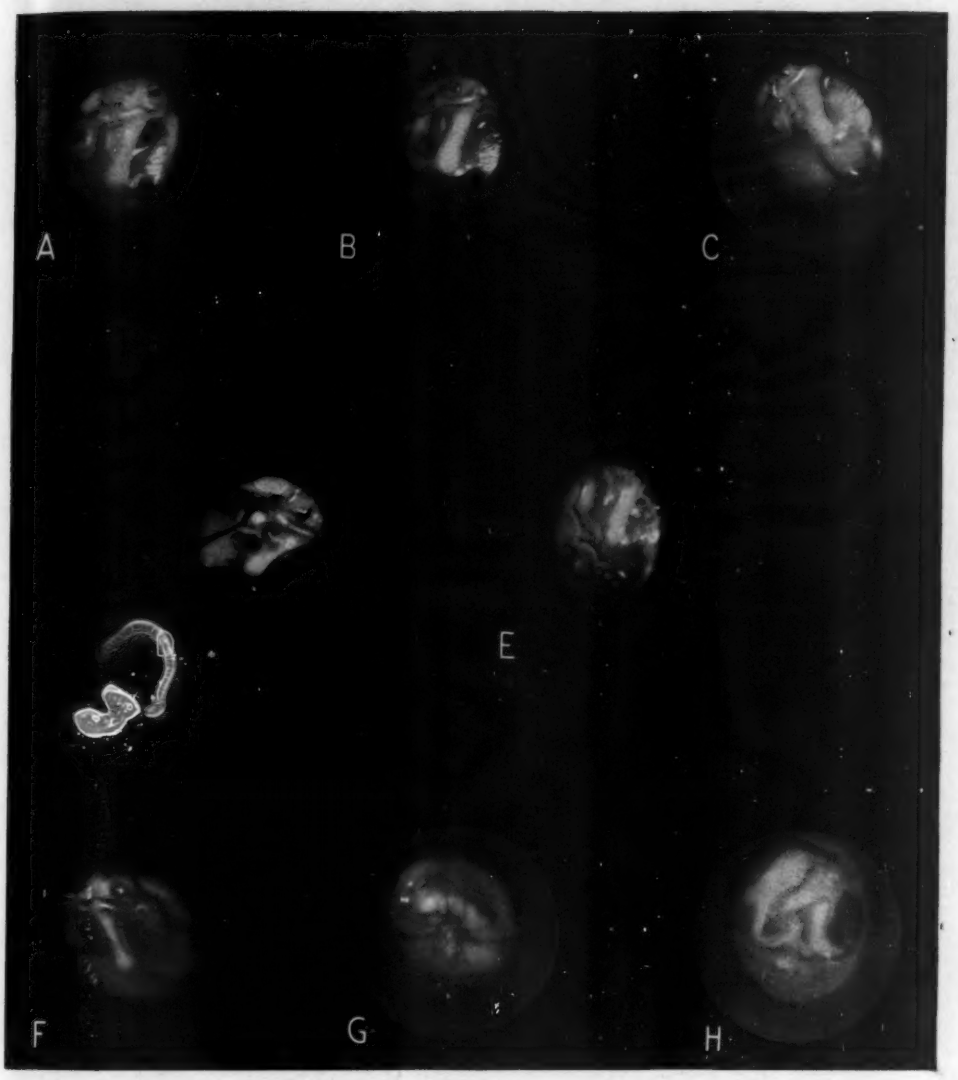

Fig. 2.—Photographic color plate showing tympanic membranes:

A, right tympanic membrane in the catarrhal stage of secretory otitis media, two days before the formation of fluid. The joint of the incus and the stapes is clearly visible. Note an old healed perforation in Shrapnell's membrane.

B, same tympanic membrane with fluid level definitely seen.

C, same tympanic membrane when the head was bent far backward, showing the shift in fluid level.

D, tympanic membrane with the head tipped markedly forward. The fluid level is now seen anteriorly. Some of the fluid has disappeared into the eustachian tube. Note several large loculated air spaces.

E, bubbles in the middle ear after inflation through catheter. The same picture is seen after Valsalva inflation.

F, left tympanic membrane hyperemic and retracted in the secretory otitis media. The fluid level can be seen anteriorly and posteriorly.

G, left drum head retracted. The anterior and posterior menisci are seen interrupted at the manubrium. A pinkish brown fluid is seen. The posterior meniscus is somewhat indistinct.

H, right drum head retracted. The short process is prominent and the long crus of the incus is easily seen. Note fluid with the upper level in the form of menisci.

it is clear yellow and serous; in others, especially if of longer duration, it may be mucoid and sticky. Only occasionally will there be so much fluid present that a pulsating serous discharge (not the same as the discharge seen in early suppurative otitis) may be seen coming through the opening; such a discharge may persist for twenty-four hours or longer. This occurred in 3 of our cases. The probability

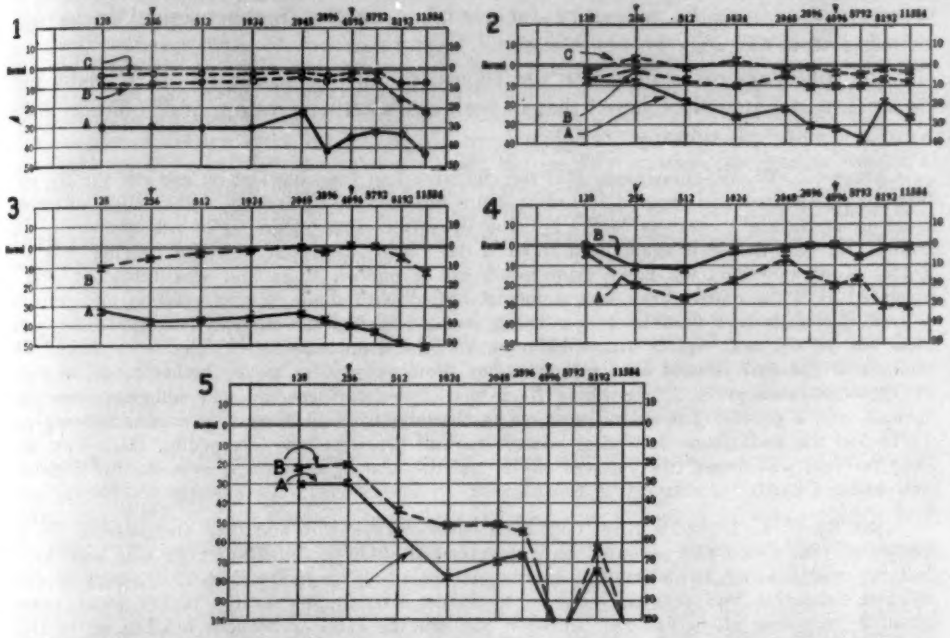

Fig. 3.—Illustrative audiograms:

1. *A*, audiometric record for the right ear in case 4 with fluid completely filling the ear. Hearing by the whispered voice test was 3/15.

B, record made immediately after myringotomy and inflation. Hearing by the whispered voice test was 12/15.

C, record made the next day, following catheteral inflation. Hearing by the whispered voice test was 15/15.

2. *A*, audiometric record for the left ear in case 5 when the ear contained fluid. Hearing by the whispered voice test was 4/15.

B, record made immediately after catheteral inflation. Hearing by the whispered voice test was 15/15, reduced in twenty-four hours to 8/15.

C, record made after myringotomy and inflation. Hearing by the whispered voice test was 15/15, persisting.

3. *A*, audiometric record for a left ear filled with fluid. Hearing by the whispered voice test was 1/15.

B, record following myringotomy and inflation. Hearing by the whispered voice test was 15/15.

4. *A*, audiometric record for a left ear contained fluid (case 6). Hearing by the whispered voice test was 10/15.

B, record following myringotomy and inflation. Hearing by the whispered voice test was 15/15.

5. *A*, audiometric record for a left ear before treatment. Hearing by the whispered voice test was 1/30.

B, record made after myringotomy and inflation. Hearing by the whispered voice test was 4/15.

is that in these cases the fluid was present in the mastoid air cells as well as in the middle ear.

One or two or even more subsequent inflations are usually necessary for complete relief and restoration of aeration of the middle ear, although in several cases myringotomy and one inflation were sufficient to relieve the complaints completely. In a few cases there is incomplete emptying of the tympanic cavity, and daily catheterization may be necessary for complete cure. If the original incision is closed, a new one may be made without hesitancy.

The following cases illustrate the typical picture of secretory otitis media and its treatment. It will be noted that in both cases catheterization and inflation alone were not sufficient therapy.

CASE 4.—J. W. W. complained that the right ear had been blocked on and off for the past five days. Examination showed the right drum head retracted and the light reflex disturbed. Hearing in the right ear was 3/15. No fluid was seen, so a diagnosis of tubotympanitis was made. He was not seen again until thirteen days later, at which time the hearing was still 3/15. Now, however, the right drum head had a pinkish tinge and was retracted, and it appeared as if the entire drum was completely filled with fluid. Catheterization and inflation proved this, a definite fluid level now being seen. Hearing had increased to 12/15, by inflation, but on the next day it was 1/15 again and the drum was again filled with fluid. The audiogram (Maico) showed an average loss in all tones, greater in the higher tones, of about 30 decibels (audiogram 1, recording *A*, in fig. 3). Myringotomy and inflation were performed, and a profuse amount of serum was blown out. Immediately after this hearing was 15/15 and the audiogram showed an almost normal hearing curve (recording *B*). Two days later no fluid was found, hearing was 15/15, and the hearing curve was even further improved (recording *C*).

CASE 5.—R. L. L. had a nasal cold three weeks previously, and then stuffiness of the left ear developed, which had persisted until examination. On examination fluid was seen in the left ear and hearing as determined by the whispered voice test was 4/15. The audiogram showed a hearing loss ranging from 10 to 35 decibels, greater in the higher tones (audiogram 2, recording *A*, in fig. 3). Inflation through the catheter brought hearing up to 15/15 and the audiogram showed an improved hearing curve (recording *B*). However, the next day hearing was dulled again (8/15) and the fluid again apparent. Inflation brought the hearing up to 15/15, but this lasted only forty-eight hours and hearing was reduced then to 8/15, with recurrence of fluid. Myringotomy followed by inflation at this time gave instant relief, and hearing improved to 15/15. Two days later the hearing was still normal as proved by the whispered voice test and the audiogram (recording *C*).

In the following case both ears were involved, one ear containing a small amount of fluid which resolved spontaneously, while the other required myringotomy.

CASE 6.—W. B. complained of stuffiness in both ears, present for the past five days, following a cold. Examination showed that both drums contained fluid; the right a small amount and the left a larger amount. No hearing loss was observed for the right ear—15/15. Moderate loss was found in the left ear—10/15 (audiogram 4, recording *A*, in fig. 3). The treatment consisted of nasal shrinkage and suction. On the following day there was little change except that the left ear contained more fluid. Myringotomy and inflation were done on this ear. Hearing increased to 15/15, and the audiogram showed improvement (recording *B*). Two days later the patient had no complaints. No fluid was seen in either ear, and the hearing was 15/15 bilaterally, the disease in the right ear having resolved spontaneously.

Recurrences are common in this type of infection. If a case presents many such recurrences, the underlying causative factors must be carefully searched for—as nasal obstruction, sinusitis, tonsillitis or nasopharyngeal abnormalities. Of the last-named, enlarged infected adenoid remnants and hyperplastic lymphoid tissue are the most common. Occasionally, as in a case described by Lawson,[8] the mastoid cells may be the site of a low grade infection and may have to be exenterated. Due to the nature of our patients—soldiers, whose observation periods varied—it is

impossible for us to evaluate recurrences accurately. However, in our series, 10 patients had definite recurrences ranging from two to seven in number, and many more gave a history of having had recurrent blockage of the ear before entering the Army.

The following cases illustrate the tendency of the condition to recur.

CASE 7.—G. G. H. was seen with the complaint of stuffiness in the left ear of ten days' duration. Examination showed fluid in the middle ear, but as hearing was only slightly impaired, treatment consisted of simple nasal shrinkage and suction. The patient was watched, and six days later the fluid had disappeared, there were no complaints and the hearing was 15/15. About two weeks later, the patient had a mild sore throat, and a week subsequent to this episode he complained of hearing difficulty in the left ear. The hearing was 4/15. Examination of the left drum head showed it to be dull, but no fluid could be seen. He did not return to the clinic for another two weeks, but on this occasion the hearing was 2/15 and the drum head had a pinkish yellow color, typical of fluid completely filling the middle ear. Myringotomy and inflation produced a profuse amount of straw-colored fluid, after which the hearing increased to 15/15. Two subsequent inflations were necessary to bring the hearing to a stationary normal level.

CASE 8.—J. N. H. gave a history of having had a stopped-up left ear for three days. The drum head was retracted and had a pinkish yellow color. The hearing was 6/15. Inflation through the catheter produced a fluid level; myringotomy released the mucoid secretion, and hearing increased to 15/15. He remained symptom free until eleven days later, when the entire symptom complex recurred with return of fluid in the middle ear. Myringotomy was again productive of thin yellow fluid, and the hearing returned to normal.

Some cases with recurrence are much more complex than these. One of the most troublesome was characterized by six separate recurrent attacks after the initial one in one ear and two in the other ear over a period of three and a half months. During this time myringotomy was done eight times on the two ears, with apparently no ill effects, as on the last visit each drum head had its normal luster and appearance and hearing by the audiometer test was normal. We never did discover the basic cause for the recurrences in this case; roentgenograms of the sinuses showed some cloudiness, but irrigation gave a negative result. Roentgen examination of the mastoid process gave negative results.

Jones [4] has recommended the use of an autogenous vaccine prepared from secretion taken from the postnasal space in treatment of patients with recurrent secretory otitis media.

EVALUATION OF THERAPY

In the series of 76 cases reported, 59, or 78 per cent, were treated by myringotomy followed by inflation of the middle ear to force out the contained secretion. In all, 99 ears were treated and myringotomy was performed eighty-nine times; these figures are drawn in part from bilateral cases and recurrent cases. With this means of therapy the results were uniformly good. Directly following myringotomy and inflation the patient experienced immediate relief and hearing was considerably improved or brought to normal. In the follow-up care it was generally necessary to repeat the catheterization and inflation several times within the next three to seven days. As a rule the patients were discharged as cured within a week or ten days. In the case of previously hard of hearing patients the hearing was brought back to the former level.

In many of the cases with myringotomy, especially the earlier ones seen in this study, simple catheteral inflation was done once or twice before paracentesis was resorted to, but, although there was temporary relief, the improvement lasted only from one-half to twenty-four hours and then was followed by recurrence of symptoms. In all probability inflation simply disperses the fluid into the various com-

ponents of the middle ear, as the mastoid antrum and the air cells, although some is driven out through the eustachian tube. Most of the fluid soon settles down to its former position.

In the later cases of the series, if the hearing loss was severe and our judgment made us feel that myringotomy was the procedure of choice, this was done immediately after the initial inflation.

In 9 ears it was necessary to repeat the myringotomy subsequently, sometimes several times, but no injurious effects on the tympanic membrane were noted.

In 8 ears the fluid disappeared, and all symptoms were relieved by catheteral inflation or politzerization. In general, these ears showed a hearing loss of not more than 10/15 to 12/15.

Spontaneous remission was observed in 9 ears, and here again the hearing loss was slight and the amount of fluid small.

Seven ears were not seen after the initial examination, and the outcome is unknown.

Three ears went on to suppuration, and the result in one was mastoiditis requiring surgical intervention.

It is possible that some of the ears on which myringotomy was done might have cleared with inflation of the eustachian tube alone, or spontaneously if left alone. This particularly may be true of the later cases of our series, when we were doing paracentesis on the first or the second visit if we thought it warranted. However, by that time our experience was such that we felt this was the treatment of choice, in order to relieve or cure the patient more promptly and render less likely that his treatment would be delayed if he were suddenly transferred.

SUMMARY AND CONCLUSIONS

The symptom complex of secretory otitis media is more common than is generally supposed. It is probable that many cases are unrecognized. Experience gained from a study of 76 cases yields the following observations:

This disease is due to a hypovirulent infection involving the eustachian tube and the middle ear with the formation of either a transudate or an exudate in the middle ear.

Pain is not commonly associated with secretory otitis media and, if present, is of short duration. Severe deafness, seemingly disproportionate to the apparent pathologic change, is often present. The drum head picture is that of retraction, with the presence of serous or mucoid fluid in the middle ear. There are various types of fluid levels. (Photographs of the tympanic membrane in color showing this condition are published for the first time. These photographs were taken by a technic originally described by me.)

Treatment is directed to the underlying pathologic process. In most cases myringotomy followed by catheteral inflation to remove the secretion from the middle ear is indicated. Fifty-nine patients were treated in this manner, with excellent results. In all, 99 ears were treated and myringotomy was performed eighty-nine times.

This disease does not tend to resolve spontaneously, for only 9 ears showed spontaneous remission. Simple inflation with or without the catheter is insufficient, as only 8 ears could be cured with this form of therapy.

Recurrences are characteristic of this disease. Ten of our patients had from two to seven recurrences. Many had a history of recurrences before coming under

our observation. In these cases the underlying pathologic condition in the nose, throat and sinuses must be carefully searched for and treated.

This disease is rarely accompanied by suppuration. Only 3 cases in our series showed this complication.

An interesting analogy between this disease and acute aero-otitis media may be seen. The analogy could be considered from the standpoint of degree, the aero-otitis being visualized as a sudden hyperacute form of the secretory type.

Further careful study of secretory otitis media is necessary, for it is apparent that a more thorough understanding of the mechanism of this disease will materially aid in the solution of that old but important problem—chronic middle ear deafness.

MUCOCELE OF THE FRONTAL SINUS

A REPORT OF FIVE CASES IN TWO OF WHICH AT OPERATION THE MUCOCELE WAS FOUND TO BE EMPTY

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Recently at the Royal Victoria Hospital a mucocele of the frontal sinus was operated on, and the sinus was found to be empty. This was the second such case in the past two years, and the finding has aroused considerable interest. In the better known reviews on the subject of mucocele no reference has been made to any similar finding. The records of the Royal Victoria Hospital for the past twenty years include 11 cases in which mucocele was diagnosed. In 3 cases the ethmoid sinus alone was involved; in 1 case the diagnosis is doubtful because no operation was performed; in 2 cases the finding was pyocele, whereas the 5 cases to be reported in this article fulfil the requirements generally accepted for a diagnosis of mucocele.

A complete survey of the literature has not been attempted. Among the more comprehensive reviews on this subject which we consulted but which are not referred to again in the text are those by the following authors: Gerber,[1] Gignoux,[2] Howarth,[3] Reverchon and Worms,[4] Thomson and M'Ilraith,[5] and Turner.[6]

There is much difference of opinion as to what constitutes a mucocele. One of the best definitions is that given by Dabney[7]: "the accumulation and retention of mucous secretion within an accessory sinus, generally associated with a distention of one or more of its walls." As Dabney pointed out, this definition has merit because it does not incorporate qualifying phrases which might suggest doubtful etiologic factors, such as "due to closure of the nasofrontal duct, etc."

Some authors have stated that mucocele of the frontal sinus is a relatively uncommon condition. Howarth,[8] stated in 1924 that he had been able to collect

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From the Department of Otolaryngology, Royal Victoria Hospital, and the Department of Radiology, Montreal Neurological Institute.

1. Gerber, P. H.: Die Komplikationen der Stirnhöhlenentzündungen, Berlin, S. Karger, 1909.
2. Gignoux, A.: Considérations sur l'évolution et le traitement des mucocèles du sinus frontal, Arch. internat. de laryng. **6**:513-526, 1927.
3. Howarth, W. G.: Mucocele and Pyocele of the Nasal Accessory Sinuses, Lancet **2**: 744-746, 1921; Large Osteoma Causing Mucocele of the Frontal Sinus and the Maxillary Antrum, J. Laryng. & Otol. **44**:390-391, 1929.
4. Reverchon, L., and Worms, G.: Mucocèle fronto-ethmoidale, pathogénie-traitement, Arch. internat. de laryng. **1**:682-691, 1922.
5. Thomson, St. C., and M'Ilraith, C. H.: Mucocele of the Frontal Sinus, J. Laryng. & Otol. **38**:365-368, 1923.
6. Turner, A. L.: Mucocele of the Accessory Nasal Sinuses, Edinburgh M. J. **22**:396-410 and 481-501, 1907.
7. Dabney, V.: Mucocele of the Nasal Accessory Sinuses; Two Cases of Pan-Sinus Involvement with Recovery After Interval Operations, Tr. Am. Laryng. A. **43**:163-179, 1921.
8. Howarth, W. G.: Mucocele of the Frontal Sinus Caused by a Large Osteoma, J. Laryng. & Otol. **39**:265-267, 1924.

references to over 300 cases. He had personally reported 21 cases. It is probably fair to assume that any one connected with the otolaryngologic clinic of a teaching hospital would see from 5 to 10 cases in his lifetime. Wilkerson [9] in 1941 pointed out that some evidence of this condition has been found in ancient skulls and stated that Berthon [10] published the first review in a thesis, in 1880.

It is interesting that Dr. Frank Buller [11] of Montreal reported a case in the first volume of the *American Journal of Ophthalmology,* in 1884.

ETIOLOGY

Opinions expressed as to the causation of mucocele are varied. This is probably due to the possibility that there may be a variety of causes or that a number of different conditions are being considered under the same title. The reader is referred to any one of the listed reviews for a discussion of this highly controversial subject. We shall not discuss it, as our cases shed no light on it.

SYMPTOMATOLOGY

The symptoms of mucocele are few. There is usually some periorbital swelling which develops slowly and as a rule painlessly, owing to depression of the floor of the frontal sinus. The floor of the sinus is most commonly distorted, though the posterior or the anterior wall may also be affected.

Examination of the interior of the nose may show no abnormality. Bertheux [12] in 1881 considered supraorbital neuralgic pain to be an early symptom, followed by serosanguinous mucoid discharge from the nostril of the affected side, and finally by deformity of the floor of the frontal sinus causing exophthalmia. He stated that movements of the affected eye are usually free but may be limited. Berthon [10] in 1880 stated that pain is common at the onset and is the only symptom while the sinus is filling.

The fluid contents of a mucocele may be sticky and mucous, may be dark and blood-stained or may be mustard-like in substance.

Lillie and Pastore [13] in 1941 reported 2 cases under the heading "Hemorrhagic Cysts of the Frontal Sinus Which Simulated Mucocele." These cysts [11] might well be classed as mucoceles containing blood-stained fluid.

DIFFERENTIAL DIAGNOSIS

A mucocele might be confused with, and must be distinguished from, any one of the following conditions:

Cystic Dilatation of the Lacrimal Sac.—In this condition the swelling first occurs at the level of the inner angle of the eye, which is below where a mucocele breaks through the anterior ethmoid cells or the inner end of the floor of the frontal sinus. It is usually possible to express some of the contents of a lacrimal cyst from the puncta or through the lower end of the nasolacrimal duct.

Tumor and Abscess Within the Orbit.—Depending on its origin, a tumor or an abscess within the orbit causes exophthalmia without necessarily causing any

9. Wilkerson, W. W., Jr.: Mucocele of the Frontal Sinus, Arch. Otolaryng. **34**:321-339 (Aug.) 1941.
10. Berthon, E.: Abcès et hydropisies des sinus frontaux, Thesis, Paris, no. 263, 1880.
11. Buller, F.: Mucocele of the Frontal Sinus, Am. J. Ophth. **1**:33-37, 1884.
12. Bertheux, P.: Kystes muqueux des sinus frontaux, Thesis, Paris, no. 425, 1881.
13. Lillie, H. I., and Pastore, P. N.: Hemorrhagic Cysts of the Frontal Sinus Which Simulated Mucocele: Report of Two Cases, Ann. Otol., Rhin. & Laryng. **50**:544-553, 1941.

deformity of the floor of the frontal sinus or other bone changes. There may also be signs within the eye of pressure on the optic nerve and of interference with eye movements, more than one would expect from a mucocele in an early stage. A tumor of the lacrimal gland occurs at the outer edge of the orbit, whereas a mucocele usually breaks through the inner end of the floor of the frontal sinus.

Tumor of the Frontal Bone.—A bony tumor can usually be differentiated from a mucocele by its roentgenographic appearance.

Epidermoid Cyst (Cholesteatoma).—Garretson [14] in 1927 stated that the epidermoid cyst is more likely to be found in the region of the outer canthus. Because it is subperiosteal, it is bound down and is displaced only with difficulty. It usually has been present from birth, and as a rule it increases in size gradually.

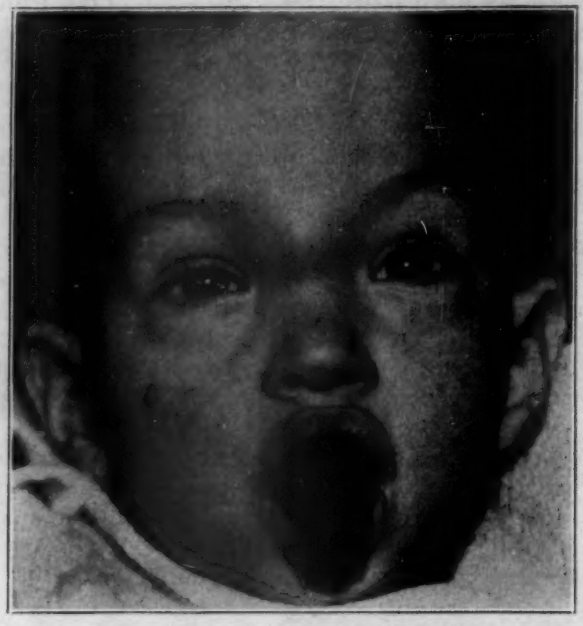

Fig. 1.—A child aged 11 months with a meningocele in the region of the glabella. (The object in the mouth is a comforter.) This case is to be reported in detail in the near future by one of us (E. A. S.).

Coates [15] described 2 cases (1 his own). The cholesteatomatous cavity was lateral to, but involved, the true sinus. Both cavities were filled with concentric layers of cholesteatomatous material similar to that found in chronic mastoid disease but without an offensive odor.

Meningocele.—This tumor is usually present from birth. It is in the midline because it occurs as a result of meningeal herniation through the frontal suture. It appears above the bridge of the nose (fig. 1). It is cystic and pulsates when the child is at rest. During crying the tumor expands. One can sometimes feel the edges of the bony opening in the skull, and roentgenograms show the spreading apart of the orbits.

14. Garretson, W. T.: Mucocele of the Frontal Sinus, with the Report of a Case, Laryngoscope **37**:350-354, 1927.

15. Coates, G. M.: Cholesteatoma of the Frontal Sinus, Arch. Otolaryng. **26**:29-37 (July) 1937.

Meningeal Fibroblastoma (Meningioma).—This tumor might occur in any part of the skull but is unusual in the frontal sinus area. Since it arises within the skull, there may be signs of intracranial involvement before there is any external swelling.

Hydatid Cyst of the Frontal Sinus.—Hydatid cyst can be distinguished only by the character of the cystic contents.

ROENTGENOGRAPHIC OBSERVATIONS AND DIFFERENTIAL DIAGNOSIS

A mucocele tends to produce dilatation of the whole or of some portion of the involved frontal sinus, and if it enlarges sufficiently, it may also involve the opposite frontal sinus. The resulting cavity is usually smooth walled, with a slightly whitened margin, and it is relatively radiotransparent. The bony septums ordinarily present in the frontal sinus are usually obliterated. Thinning and bulging of the bony walls may occur, and defects may be present, the floor usually being primarily involved.

There are not many other conditions which can give a similar roentgenographic appearance. In osteomyelitis of the frontal bone there will be no roentgen findings for the first ten days or two weeks except for clouding of the sinus, but later there will be evidence of bone destruction and still later of new bone formation. Many of the orbital tumors produce no bony changes. Osteoma and osteofibroma give rise to new bone formation of varying degree and density, but there is no associated cavity formation. Meningeal fibroblastoma may be accompanied by bony thickening and sometimes by increased vascularity, but no cavity is present. Cystic dilatation of the lacrimal duct produces no deformity of the frontal sinus region. With a meningocele there is a defect in the frontal bone in the midline, but there is no transparent cavity. The orbits are apt to be spread farther apart than they normally are, particularly the superior portions of the orbits. Epidermoid (cholesteatoma) is almost the only condition which may cause confusion. Such a tumor occasionally occurs in the frontal bone, and as it slowly increases in size it may erode the margin of the frontal sinus. The margin is usually smooth and dense and the tumor radiotransparent owing to its high cholesterol content. This condition was seriously considered in case 3, but the operative findings ruled it out.

TREATMENT

When a mucocele involves the frontal sinus, the most important factor in treatment is adequate and permanent drainage; this can be obtained only by an external operation. It is not usually necessary to collapse the affected sinus. The establishment of free nasal drainage by removing the anterior ethmoid walls is essential. Disturbance of the lining of the frontal sinus or of the cyst is rarely necessary if adequate nasal drainage has been established. The entire floor of the affected frontal sinus must be removed. This is most important when there is displacement of the eye, as it allows the eye to return to its normal position within the orbit. If the opposite frontal sinus is involved secondarily without any displacement of the eye on that side, it is not usually necessary to establish drainage into that nostril. It is important, however, that the septum between the frontal sinuses be completely removed. A large drainage tube inserted from the frontal sinus to the nose and maintained in position for about six weeks is a great help in establishing permanent drainage. The patient should be kept under observation for a year or two in order that frequent dilations of the new nasofrontal duct may be carried out and stenosis and reformation of the cyst avoided.

CASE 1

A man aged 74 was admitted to Dr. W. V. Cone in the Montreal Neurological Institute in March 1939. His symptoms dated back to 1927. He first noticed some irritation and redness of the left eye, and there was some diplopia. About 1933 the left eye protruded slightly and there was some limitation of movement of the eyeball. Vision in that eye became diminished. The protrusion of the eyeball was progressive. One week before admission pain and redness developed in the left eye (fig. 2). For years the patient had noticed some loss of hearing in the right ear. There was loss of the sense of smell. He suffered from nasal discharge for over thirty years. He was subject to chronic bronchitis and asthma. He did not have headache, tinnitus, dizziness or photophobia. The Wassermann reaction of the blood was negative.

On examination it was found that the left eyeball was pushed downward and outward by a large swelling involving the floor of the left frontal sinus and the left frontomaxillary process. The bone over the swelling crackled on compression. There were ocular opacities

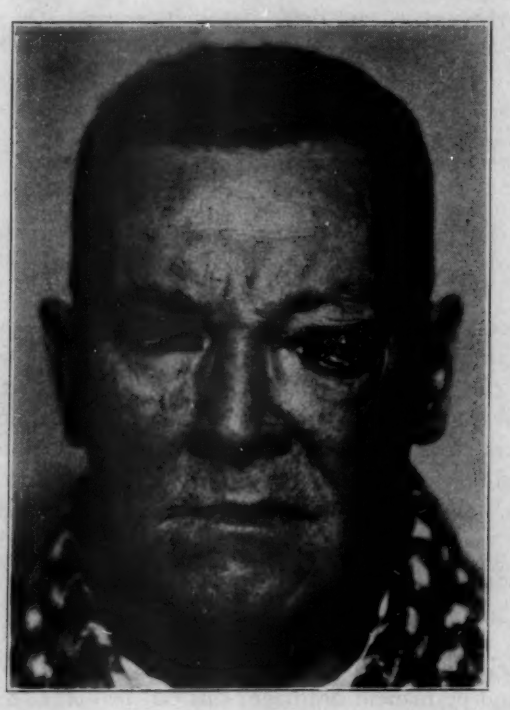

Fig. 2 (case 1).—A photograph taken on the day of operation, showing a downward and outward displacement of the left eye and chemosis of the conjunctiva.

and suffusion of the conjunctiva. The vision was diminished in the left eye. There was no infection or inflammation of the left side of the nose, but there were nasal polyps in the right nostril. There was mucopurulent discharge in both the middle and the superior meatus of the right nostril. In other words, the intranasal evidence of sinusitis was on the side opposite to the displaced eye.

Roentgenographic examination on March 14, 1939 revealed a somewhat transparent cavity with a width of 6 cm., a height of 5.5 cm. and a depth of 3 cm., occupying the position of both frontal sinuses. The bony margin of this was dense and smooth (fig. 3 *A*). It was more extensive on the left side, where its most lateral limit was situated opposite the mid-portion of the superior orbital margin. The frontal bone anterior to this cavity was thick and dense, particularly near the midline, and at its superior margin there was a bony projection which extended approximately 1 cm. into the skull (fig. 3 *B*). There was a defect in the bony wall posteriorly, 3 cm. in diameter, and there was also a defect in the anterior part of the superior orbital plate on the left side. The anterior ethmoid cells were partially destroyed on both sides.

The general physical examination showed arteriosclerosis and myocardial changes. A diagnosis was made of mucocele of the left frontal sinus invading the right frontal sinus. The patient was transferred to the otolaryngologic department for operation. A left frontoethmoidal approach was decided on. The operation was done by one of us (W. J. McN.) on March 15 with the patient under general anesthesia. Both frontal sinuses were found

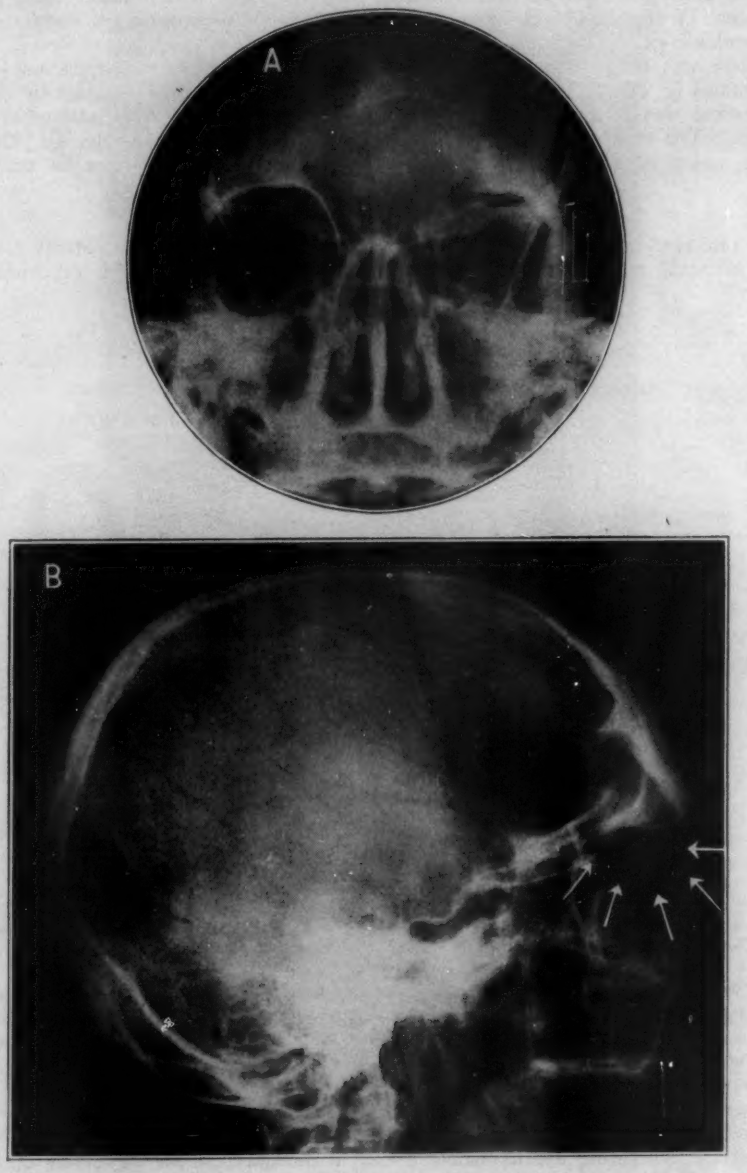

Fig. 3 (case 1).—*A*, large mucocele involving both frontal sinuses. *B*, left lateral view of the mucocele. Note the bony projection into the skull at its superior margin. The inferior limit is outlined by arrows.

to be filled with thick chocolate-colored fluid and mustard-like material. The cyst wall measured about 3 mm. in thickness. Some of it was removed for histologic examination. The fluid contents of the cyst measured about 2 ounces (59 cc.). There was free communication with the right frontal sinus. In the posterior wall of the left frontal sinus there was an exposure of the dura over an area which measured about 3 cm. in diameter. The anterior

part of the bony roof of the left orbit had been absorbed. The floor of the left frontal sinus was entirely removed, and a large opening was made through the left anterior ethmoid cells to afford free drainage into the left nostril. A rubber tube, 1 cm. in diameter, leading from the frontal sinus into the left nostril was kept in position for one month. At the end of the operation the left eye could be pushed back into its normal position within the orbit. Two weeks later nasal polyps were removed from the right nostril under local anesthesia. This evidence of allergic rhinitis was probably not a factor in causing the mucocele.

On histologic examination the cyst wall was reported to be fibrous and devoid of epithelium. There was no growth of organisms from the fluid removed at operation. The eyes were examined by Dr. J. V. Nichols on April 4, who reported some cataractous changes.

The patient was last seen in January 1940. At that time the left nasofrontal duct was freely open. The exophthalmia on the left had practically disappeared (fig. 4). Dr. Nichols found the vision in the left eye further reduced because of an increase in the lenticular opacities.

CASE 2

A woman aged 20 was admitted to Dr. Wilder Penfield in the Montreal Neurological Institute in April 1941. In July 1939, when recovering from an attack of chickenpox she

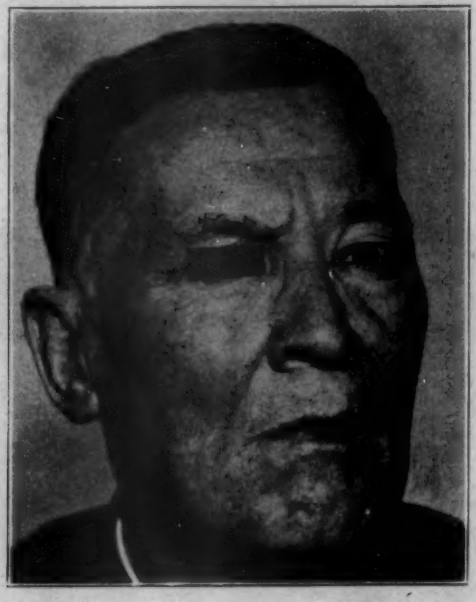

Fig. 4 (case 1).—A photograph taken on July 5, 1939, four months after operation.

first noticed a depression over the right side of her forehead. The bone could be depressed like a ping-pong ball. There was no discomfort. A roentgenogram made at that time showed some absorption of the bone in the right frontal sinus area. A year later some swelling was first noticed over the right frontal sinus. This swelling increased slightly for a few months and then became stationary.

Roentgenograms made on April 2, 1941 revealed the left frontal sinus to be normal in appearance and showed no abnormality of the ethmoid cells or of the antrums. There was a large cavity, measuring approximately 5 cm. in diameter, in the right side of the frontal bone occupying the position of the frontal sinus. Its margin was rather dense, and an occasional small irregularity was present (fig. 5). The cavity extended to the right as far as the lateral part of the orbital margin, but it did not involve the margin itself and had not depressed the superior orbital plate. There were no partitions running through it. These films corresponded closely to those made in July 1939.

The history and the general physical examination did not reveal anything abnormal. The Wassermann reaction of the blood was negative. The interior of the nose was examined with a nasopharyngoscope and was found to be normal. The eyes were symmetric. On palpation there was a suggestion of a depression of the floor of the right frontal sinus. There

was an obvious swelling of the right side of the forehead, about 5 cm. in diameter. It projected forward from the surface about 4 to 5 mm. It was firm on palpation, with no thickening, discoloration or tenderness of the overlying skin.

A diagnosis of mucocele of the right frontal sinus was made, and it was decided to drain the mucocele into the nose by an external operation on the frontal and ethmoid sinuses. The

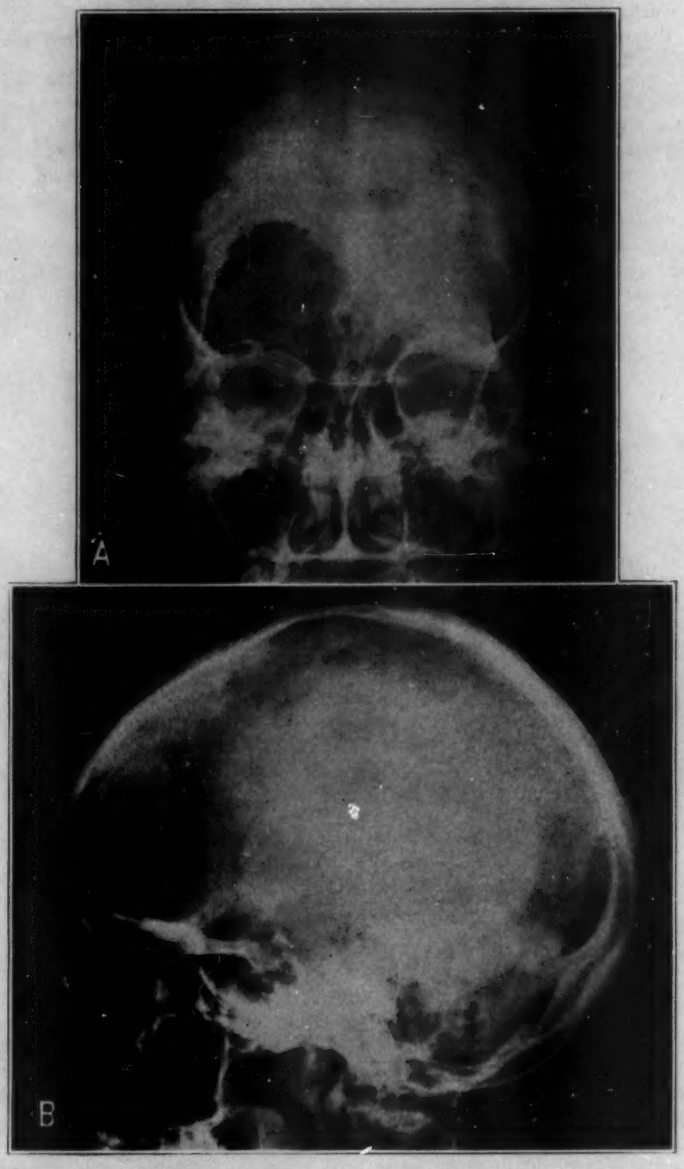

Fig. 5 (case 2).—*A,* roentgenogram made on April 2, 1941, showing a large cavity situated in region of right frontal sinus. The left frontal sinus is normal. *B,* right lateral view. The thin anterior wall is not well shown but is plainly visible in the original film.

patient was transferred to the otolaryngologic service, and the operation was performed by one of us (W. J. McN.) on April 5 with the patient under intratracheal anesthesia. When the floor of the right frontal sinus was exposed, it was found that the bone had been absorbed over a number of areas. The frontal sinus was opened, and to our surprise it was empty,

the mucous membrane appearing to be healthy. The bone of the posterior wall of the sinus was palpated and seemed to be intact. Bits of bony wall and sinal mucous membrane were removed for histologic examination and were reported to be normal. The nasofrontal duct could not be identified. The floor of the frontal sinus was completely removed. A large drainage opening was made into the nose by removing the anterior ethmoid cells. A rubber tube 1 cm. in diameter was inserted from the frontal sinus to the nose and was kept in position for two weeks.

Following the operation, the patient's mother on being questioned stated that two weeks before admission there had been a copious nasal discharge.

Fig. 6 (case 2).—Photographs taken on Dec. 16, 1942, about two years after operation, showing a persistent prominence of the right side of the forehead.

When the patient was examined in September 1942, there was no change in the external appearance of the right side of the forehead (fig. 6). The swelling was still present. The right nasofrontal duct measured about 5 mm. in diameter. Through it a probe could be passed into either frontal sinus. To prove this, iodized poppyseed oil 40 per cent was instilled into both the left and the right frontal sinuses and roentgen studies made. No change had occurred in the roentgen picture since the operation a year and a half before.

Some condition had existed in the right frontal sinus which expanded the anterior wall and caused partial erosion of the floor of the sinus. No evidence

of bone disease was found at operation. A mucocele is about the only condition which could cause such a sinus deformity and then disappear, probably by rupturing into the nose, leaving an empty frontal sinus lined with normal-appearing mucosa. In the two years since operation, the nasofrontal duct being open, there has been no further change in the right frontal sinus.

CASE 3

A man aged 28 was admitted to the Montreal Neurological Institute on Oct. 22, 1942. Ten years previously he noted a narrowing of the palpebral fissure on the left side which was progressive. Three years prior to admission he noted that his left eye was lower than his right. Since that time there had been a progressive downward movement of the left eye associated with proptosis (fig. 7). There was no diplopia. For a period of ten years he suffered from supraorbital headaches, more marked on the left side and increased by bending forward.

The patient's general condition was normal. The Wassermann reaction of the blood was negative. The left eye was proptosed and directed downward. There was no disturbance of vision. The fundi were normal. There was no excessive tearing. There was a slight prominence of the left supraorbital region. One could feel what appeared to be a ridge of

Fig. 7 (case 3).—A preoperative photograph taken on Oct. 27, 1942, showing downward displacement of the left eye.

bone protruding into the orbit from the floor of the frontal sinus. This ridge extended throughout the length of the supraorbital ridge.

Roentgenograms of the skull and sinuses made on October 20 showed both frontal sinuses to be large. There was a transparent cavity measuring 4.3 cm. in diameter, with a clearcut, slightly whitened margin, situated mainly in the left superior orbital plate (fig. 8 *A*). It extended laterally as far as the zygomatic process of the frontal bone, and it extended posteriorly to within 1 cm. of the lesser wing of the sphenoid bone. The bony wall was partially defective superiorly, and the cavity bulged slightly upward into the cranium. There was considerable downward protrusion into the left orbit (fig. 8 *B*). Medially a communication with the lateral part of the left frontal sinus was plainly visible.

The patient was transferred to the otolaryngologic service for operation on the frontal sinus. An external operation on the frontal and ethmoid sinuses was performed by one of us (E. A. S.) with the patient under general anesthesia. The lamina papyracea was absent in front of the anterior ethmoidal vessels. The anterior ethmoid labyrinth had been compressed into a space continuous with the left frontal sinus. The bony floor of the frontal sinus was absent except for an anterior and lateral margin, the edges of which protruded downward into the orbit. When opened, the frontal sinus was found to be empty. The septum between the frontal sinuses was absent. There was a dural exposure through the posterior wall of the left frontal sinus measuring 2 cm. in diameter. Sections of bone and mucous membrane from various parts of the sinus walls were examined histologically and were found to consist of essentially normal tissue. The lining of the frontal sinus was thin in appearance. This was not removed. A large opening was made into the nose through the anterior ethmoid cells, and rubber tubing was inserted from the frontal sinus into the

nose. This was left in position for six weeks. The postoperative course was uneventful. The eye returned to its normal position in the orbit immediately after operation (fig. 9).

The patient was last seen two months after operation, at which time the left nasofrontal duct was open, and the eye had returned to its normal position within the orbit.

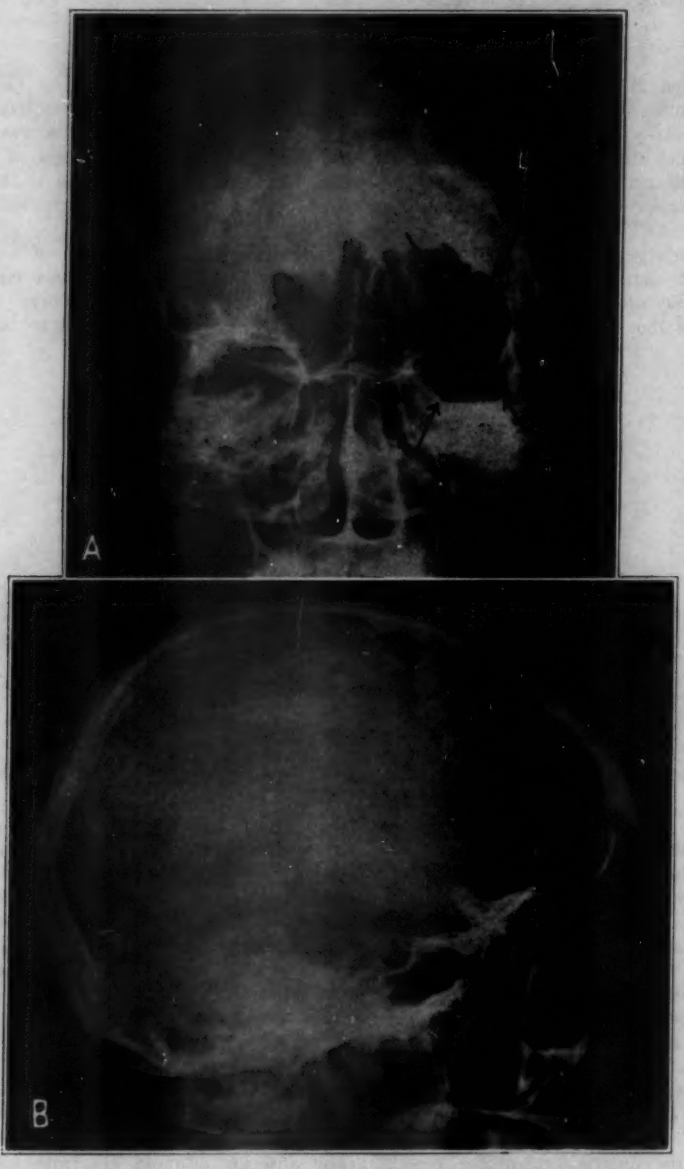

Fig. 8 (case 3).—There is a large transparent cavity situated mainly in the left superior orbital plate. It communicates with the lateral portion of the left frontal sinus and bulges upward into the cranium and downward into the orbit. In *B* the upward extension into the skull is well shown (see arrows).

It is reasonable to assume that the pressure within the frontal sinus caused the changes in the affected sinus and orbit. Most likely this pressure was caused by fluid which at some time prior to operation escaped, leaving the cavity empty.

CASE 4

A woman aged 54 was admitted to the Royal Victoria Hospital on May 11, 1925. She complained of a painless swelling above the inner canthus of the left eye, which had developed slowly over a period of seventeen years. She occasionally had diplopia.

Examination revealed marked proptosis of the left eye. A mass about the size of a "small walnut" was present in the nasofrontal region. This was adherent to the underlying bone. The orbital roof on the nasal side felt irregular. Fluctuation was felt over the mass. Dr. Gordon Byers estimated the vision of the affected eye to be 6/9; the tension was increased, and 3 mm. of proptosis was present. There was no limitation of eye movements. Diplopia could not be demonstrated. Roentgenograms provided little additional information. The Wassermann reaction of the blood was negative.

The left frontal sinus was opened by external operation on May 18 by Dr. H. S. Birkett. A cystic swelling was found, which when opened yielded about 1½ ounces (46 cc.) of greenish yellow fluid. The cavity thus entered included both frontal sinuses, there being no septum present. No communication with the nose could be found. The cystic fluid did not reveal bacterial growth. The external wound was closed with a drain in the lower end, which was removed ten days after operation. When the patient was discharged on June 1, the wound was still draining. After six weeks the wound healed and no further symptoms were experienced. Slight proptosis and some fulness of the upper eyelid persisted until her death in 1941.

Fig. 9 (case 3).—A photograph taken on Nov. 25, 1942, three weeks after operation.

CASE 5

A man aged 67 was admitted to the Royal Victoria Hospital on June 11, 1930. Eight months prior to admission his friends had noted that his right eye was smaller than his left. For one month he had been conscious of a gradual closing of the right eye. He had not experienced pain or disturbance of vision.

On examination, marked proptosis of the upper right eyelid was found. The lid could not be raised voluntarily. The right eyeball was directed downward and slightly outward. Vision was reduced in the affected eye. A mass was felt along the inner two thirds of the supraorbital margin, extending toward the back of the orbit. Eye movements were full on the normal side but were restricted in all directions on the affected side. A purulent discharge was present in the right middle meatus of the nose. The roentgenograms of the sinuses were unsatisfactory and provided little additional information. General medical examination showed normal conditions. The Wassermann reaction of the blood was negative.

Radical antrotomy was performed on the right antrum on June 13. The mucosa was found to be thin, gray and dirty. Pus was present in the antrum.

On June 18 the right frontal sinus was opened by external operation by one of us (W. J. McN.). The floor of the frontal sinus was found to have been absorbed. The sinus was filled with thick mucous secretion. The anterior and posterior walls were intact. A large opening was made through the anterior ethmoid cells, and a rubber drain was inserted and left in position for six weeks. This patient lived some distance from Montreal and was not seen after leaving the hospital.

SUMMARY

The unusual circumstance in these 5 cases, reported as cases of mucocele, is that in 2 the mucocele was found to be empty at operation. These have been classed as cases of mucocele because, as pointed out in the comment following each case, it would be impossible to explain the findings in any other way.

There is no clinical method of determining that such a sinus is empty without operation. An external exploration of the sinus is more likely to insure permanent intranasal drainage.

Conditions most likely to be confused with mucocele are pyocele, cyst such as hydatid cyst and epidermoid. The distinction can be made only by operation, and the operative treatment—permanent and free intranasal drainage—is the same in them all. Roentgenograms are a valuable adjunct in diagnosis.

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Case Reports

HYPERTELORISM

LIEUTENANT COLONEL ALFRED B. BERKOVE, MEDICAL CORPS, ARMY OF THE UNITED STATES

Hypertelorism is a congenital abnormality the diagnosis of which is made evident by the facial appearance. The person so afflicted has an animal-like countenance. It may be defined as a craniofacial dysostosis resulting from overgrowth and early ossification of the lesser wings of the sphenoid bone leading to separation of the orbits, large interpupillary distance and excessive width at the base of the nose with distortion of the tip. In most cases there is a divergent squint.

The earliest description of this condition was published by Giovanni Battista, who called attention to the facial resemblance of his patient to the bovine.

Greig [1] introduced the term "ocular hypertelorism" because of the prominent orbital abnormality. He also described the cause after autopsy in a case in which he found enormous enlargement of the lesser wings of the sphenoid bone. Bojlen and Brems [2] in subsequent autopsies confirmed the anatomic observations of Greig.

The patient's physical development and mentality may be otherwise entirely normal. In many cases reported, however, other developmental abnormalities have been noted. Syndactylism, undescended testes, mental underdevelopment and other defects have been described.

DIFFERENTIAL DIAGNOSIS

This anomaly must be differentiated from congenital nasal deformities, ethmoidal mucocele and tumor causing the characteristic frog face, and meningocele growing down into the nasal space.

TREATMENT

There is no treatment except plastic procedures to improve the strabismus and the deformity of the nasal tip.

PROGNOSIS

The defect in otherwise normal persons does not incapacitate in any way except for the facial appearance.

HEREDITY

The condition is apparently transmitted as a recessive defect.

REPORT OF A CASE

Private C. N., aged 22, reported to the Eye, Ear, Nose and Throat Clinic of the Station Hospital, Camp Beale, Calif., on Feb. 25, 1943, complaining of visual impairment and soreness of both eyes.

The family history was not significant.

On physical examination the soldier presented prominent frontal bosses. The eyes were separated by a divergent squint, and, in addition, the orbits appeared widely separated because of excessive width of the base of the nose. The tip was rather pointed and curved downward, giving the face the described animal-like appearance.

Ocular examination revealed chronic marginal blepharitis.

1. Greig, D. M.: Hypertelorism, Edinburgh M. J. **31**:560, 1924.

2. Bojlen, K., and Brems, T.: Hypertelorism, Acta path. et microbiol. Scandinav. **15**: 217, 1938.

Fig. 1.—*A*, anterior view of patient showing prominent bosses, separated orbits and exotropia.
B, side view showing the nasal tip and the facial contour.

Fig. 2.—*A* and *B*, roentgenograms showing the wide lesser wings of the sphenoid.
C and *D*, roentgenograms showing the increased width between the orbital foramens.

The visual acuity was: right 20/70; left, 20/30. A +1.00 diopter spheric lens brought the acuity of vision in the right eye to 20/50; the left eye could not be improved.

The pupillary distance measured 84 mm.; on perimetric examination the right eye deviated 35 degrees from the midline, with the left eye fixing. The media and the fundi were normal.

Questioning of the patient brought out his inability to grasp earlier school teaching or the present army routine. He stated that he desired to return to the farm because it was too difficult to grasp the subjects being taught him in his armored regiment.

A diagnosis of hypertelorism was made, and the patient was sent to the x-ray department for study of the sphenoid bone. The diagnosis was confirmed as shown by the enlarged lesser wings of the sphenoid bone and the increased width between the optic foramens.

MASTOIDITIS, MENINGITIS AND ABSCESS OF THE TEMPOROSPHENOIDAL LOBE

LESTER L. COLEMAN, M.D., NEW YORK

A case of mastoiditis, meningitis and abscess of the temporosphenoidal lobe is presented specifically to illustrate (1) the masking effects of the sulfonamide compounds on otogenous infection and (2) the surgical approach to the meninges by multiple incisions of the dura made at the time of mastoidectomy, in substantiation of the procedure outlined by Dr. Daniel Cunning.

S. W., an 11 year old boy, was admitted to the service of Dr. Daniel Cunning on April 17, 1943, with the following history:

One month before admission he had measles, and pain developed in the right ear. The right drum ruptured spontaneously twenty-eight days before admission, with some relief of pain. The ear discharged for four or five days and then apparently cleared up. The boy went back to school for three or four days and felt well. About eighteen days before admission the pain in the right ear returned, and the drum again ruptured spontaneously, this time, however, with no relief of pain. The family physician gave the patient sulfanilamide at four hour intervals for three days. The ear continued to drain for five or six days thereafter, and then drainage ceased about nine days before admission, but the pain in the ear persisted. The administration of sulfanilamide was again started and was maintained for three more days. The patient's temperature had been ranging between 101 and 102 F. for two weeks before admission. Five or six days before admission he complained of occipital headache, pain over the right mastoid process and pain over the right eye. The day before admission, myringotomy was done on the right side with release of pus under pressure from the middle ear. Throughout the period of acute infection the patient was given sulfanilamide inadequately, sporadically and in an uncontrolled way, with no recognition of the fact that the underlying pathologic condition was progressing in the presence of the drug.

At the time of admission the boy was acutely ill. There was a profuse thick discharge from the right ear, with tenderness over the mastoid process. There was no evidence of meningeal involvement or of photophobia. Examination of the left ear revealed it to be essentially normal.

Ten hours after admission the patient became stuporous and unresponsive. His temperature rose to 104 F., and he was drowsy. Examination at this time showed an active pulsating discharge of thick yellow pus from the right ear. The pus was subsequently cultured and the growth identified as Streptococcus haemolyticus. There was sagging of the superior wall of the external canal, and even in the semicomatose state of the patient pain was elicited on pressure over the mastoid process. There was nuchal rigidity, with Kernig's sign present bilaterally and Brudzinski's sign. There were no cranial nerve palsies and no focalizing signs. The patient's temperature at this time was 105 F. A diagnosis of meningitis of otitic origin was made, and mastoidectomy was advised. The spinal fluid before operation was cloudy, with increased albumin and globulin, 1,800 white cells, almost all polymorphonuclears; bacteria were seen by stain and on being cultured were identified as Str. haemolyticus; the white cell count on the blood was 34,200 with 88 per cent polymorphonuclears; the hemoglobin content was 90 per cent. This, however, was unreal, being secondary to dehydration.

Simple mastoidectomy was done on the right side; the cortex was removed with mallet and gouge. The cortex was sclerotic, as was most of the mastoid process. Frank pus was obtained immediately, which was subsequently cultured and the growth identified as Str. haemolyticus. The lateral sinus had been exposed by the disease and was covered by a huge perisinal abscess. A tremendous amount of pus under pressure issued forth between the sinus plate and the sinus. The latter on palpation seemed to be filled with blood. There was a pathologic exposure of the dura of the middle fossa, with pus under pressure beneath the dural plate. The dura of the middle fossa was exposed by removal of the sinodural angle, as was the dura of the cerebellum. The sinus was exposed from the knee down to the jugular bulb. The dura was exposed until normal-appearing dura was seen. The dura of the middle fossa herniated into the wound in the region of the zygoma. At the suggestion of Dr. Cunning,

From the service of Dr. Daniel L. Cunning, Manhattan Eye, Ear and Throat Hospital.

multiple incisions of the dura were made, at which time 5 or 6 drachms (18 to 22 cc.) of thick pus under tremendous pressure, mixed with spinal fluid, exuded. It could not be ascertained at this time whether the pus was issuing from a subdural abscess or an abscess of the temporosphenoidal lobe. After the pus was evacuated through the incisions in the dura, a vein of large caliber was pushed into view. This vessel looked like a dilated vein of the cerebral cortex and permitted one to believe that the evacuated pus had been released from the subdural or the subarachnoid space. The wound, after being sprinkled with sulfathiazole, was packed lightly with gauze and left wide open.

Following operation, on April 18, 1943, the following regimen was prescribed: a daily spinal tap, sulfadiazine 225 grains (15 Gm.) and the Trendelenburg position. For the first few days after operation the concentration of sulfadiazine in the blood was 52.8 mg. per hundred cubic centimeters. At that time the concentration in the spinal fluid was 40 mg. per hundred cubic centimeters. Twenty-four hours after operation the boy had marked swelling over the left parotid area which was highly suggestive of parotitis. This subsided after a few days without any intervention. The patient was fortified with a continuous intravenous injection of dextrose and saline solution and blood transfusions, and the urine was kept alkalinized. Then edema of the extremities developed, due to hydration. There was a moderate amount of hypoproteinemia. Alkalinization was maintained with tenth-molar sodium lactate solution. His temperature fell postoperatively and then maintained a level ranging from 99 to 101 F. daily except for one elevation of 103 F. associated with a chill and a negative blood culture following a transfusion. The temperature ran this subfebrile course until May 4, sixteen days after the original operation. During this interval the eyegrounds showed blurring of the nasal margins of both disks, with small pinpoint hemorrhages, thought to be due to increased intracranial pressure. Spinal fluid pressure during this stage ranged about 300 mm. Cultures of the spinal fluid were repeatedly positive for Str. haemolyticus for ten days. The blood cultures remained constantly negative. There were no meningeal signs at this time.

On May 2, fourteen days after operation, the child became more toxic, was drowsy, with an acetone odor from his breath and complained of retro-orbital pain; the neck became more rigid, Kernig's sign returned, and there was a slight suggestion of a supranuclear facial palsy on the right. The Ajala index was 4.5, which was suggestive of an expanding lesion, probably an abscess of the brain. Dr. Zabriskie examined the boy and found him to be irritable, uncooperative, not stuporous. There were partial supranuclear facial palsy and left ankle clonus, with Babinski's sign. There was no aphasia or hemianopsia. The left pupil seemed larger than the right, and, because of pyramidal signs, exploration of the temporosphenoidal area seemed indicated.

On May 4, the wound was reopened with the patient under general anesthesia. The dura of the middle fossa was exposed at the original site of the incisions. These had closed over. The dura was reincised with a crucial incision, and the temporosphenoidal lobe was entered for a distance of 4 cm. About 1 ounce (29.5 cc.) of dirty brown spinal fluid flowed into the mastoid cavity, followed by about 1 ounce of frank pus which, subsequent culture showed, contained Str. haemolyticus. A Mosher basket drain was then inserted into the temporosphenoidal lobe and sutured into place through the dura and later through the skin. The wound was packed with iodoform gauze after sulfanilamide had been blown into the abscess cavity. After the insertion of the Mosher drain the spinal fluid pressure rose to 650 mm., and spinal taps daily and sometimes twice daily failed to reduce the pressure perceptibly. The eyegrounds showed papilledema of 1 to 1½ diopters, with occasional hemorrhage in the superior nasal quadrant on the right. The sustained spinal fluid pressure, which ranged between 450 and 700 mm., indicated the possibility of reactive otitic hydrocephalus.

Daily dressings were necessary to keep the fibrous deposit at the end of the Mosher basket from closing the orifice, thus preventing drainage. An incidental Bacillus pyocyaneus infection was readily controlled with boric acid powder. The amount of sulfadiazine was slowly reduced during the next few weeks as the spinal fluid became bacteria free on repeated culture. For the next four weeks, despite the fact that the child was markedly comfortable and completely free of symptoms and that the blood and spinal fluid cultures were consistently negative, the spinal fluid showed persistent elevation of pressure, and there was an unexplained fever, with the temperature ranging from 99 to 101 F. daily. At this point, because of the presence of blood in the urine, sulfanilamide was given instead of sulfadiazine. The patient was alkalinized during all this interval, being given solution of three chlorides U. S. P. intravenously and calcium lactate by mouth. The casts and red cells cleared completely. After a few days the possibility of a sustained fever due to the sulfonamide compounds was entertained, and the dosage slowly reduced, with no ill effects.

On May 24, twenty days after the operation for abscess of the temporosphenoidal lobe and thirty-six days after the original operation, the Mosher drain was removed. For ten days thereafter the temperature dropped to lower levels; then suddenly on the eleventh day (June 3), it rose to 104 F. and persisted at that level for ten days. At this time the patient was receiving 7 grains (0.45 Gm.) of sulfanilamide three times daily. This therapy was discontinued so that there would be no masking of the clinical picture by the drug. There were no localizing signs. Because of the cervical adenitis, I suspected infectious mononucleosis, but this was not substantiated by heterophile agglutination or by the results of studies of the blood. Blood culture gave a negative result. The spinal fluid pressure was elevated to 540 mm.; there were no meningeal signs, no rash, no bradycardia, no evidence of endocarditis or of pneumonia. The chest was clear by roentgenogram. The urine was normal.

A, anterior-posterior roentgenogram of the skull showing the Mosher basket in situ.

B, roentgenogram of the skull, lateral view, showing the Mosher basket drain in situ.

C, roentgenogram of the skull, lateral view, showing a metal probe in the abscess cavity during one of the dressings.

Dr. Zabriskie again saw the boy and could find nothing in the central nervous system to account for the temperature. A Penrose drain was inserted into the site of the original cerebral abscess. A small amount of pus issued forth. As soon as drainage was established and maintained by rubber tubing, the temperature dropped to normal perceptibly and stayed normal until he was discharged three and one-half weeks later.

At the time of discharge the boy showed no residual signs; the eyegrounds were normal; the spinal fluid pressure was normal; the hearing was perfectly normal, and the wound closed completely and satisfactorily.

COMMENT

The case reported illustrates the masking effect of sulfonamide compounds when injudiciously used in the treatment of otogenous infections. It illustrates the value of the sulfonamide compounds after the surgical focus has been adequately and thoroughly removed. It indicates the value of a relatively courageous incising of the dura in suspected cases of subdural disease and meningitis. It further illustrates the necessity for constant supervision and evaluation during the entire period that sulfonamide compounds are used.

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OTOSCLEROSIS IN IDENTICAL TWINS

HARRY C. ROSENBERGER, M.D., CLEVELAND

The accumulation of data relating to the genetic and environmental factors of otosclerosis is a groping maneuver in the search for the cause and the ultimate cure of this disease. It is admitted that it is a poor substitute for successful and illuminating laboratory investigation. In the absence of the latter one would do well to follow the example and advice of Fowler,[1] who urges the detailed reporting of cases of identical twins afflicted with otosclerosis.

The identical twin girls S. J. R. and M. A. R., the subjects of this report, were adopted by F. R. when only a few months old. In so far as known by F. R. the parents were not otosclerotic. The Wassermann reaction of the blood was negative, and the basal metabolic rate was slightly elevated for each twin.

My first contact with these children was in May 1928 when the foster father, a physician, asked me to perform tonsillectomy and adenoidectomy for his adopted twin girls aged 3 years, who were experiencing more than the average number of colds and sore throats. Deficient hearing was not then a complaint or a problem, and unfortunately no hearing tests were made. Parenthetically, I should like to point out, especially to the younger otologists, the wisdom of always making complete records of patients. This instance is an example of an omission of a general rule and is regrettable. Each child had embedded, friable tonsils and a fair, though not excessive, amount of adenoids, which were carefully removed.

The twins were next seen eleven years later in April 1939 because of deficient hearing. Their records from that date will be considered separately.

S. J. R., aged 13, was referred in April 1939 because of diminished hearing, noted by the parents for an indefinite time and considered the result of frequent colds, from which the patient still suffered. Measles had occurred in childhood without complication. There was no history of suppuration of the middle ear at any time. The menses had just begun and were normal. Tinnitus was noted in the right ear and was increasing. The ears did not feel stuffy. Examination revealed normal tympanic membranes and bulbous turbinates with some nasal congestion, not allergic in appearance. There were definite, though moderate, hypertrophic pharyngitis and negligible adenoid regrowth. The orifices of the eustachian tubes were free of evident lymphoid tissue. The teeth were normal. The child appeared in good health. I advised that an audiogram be made, that thiamine hydrochloride be prescribed, that roentgen therapy to the eustachian tubes be tried and that the tubes be occasionally inflated.

In January 1942 another audiogram was made. The following month the ears, nose and throat were reexamined. Head colds were still bothersome in spite of vitamins, cold vaccine and other medicaments. Diminished hearing was noted with every cold, with apparent recovery between colds. Tinnitus now affected both ears. The eustachian tubes were normally patent on inflation. As a precaution for the future, lip reading was advised. Poor bone conduction contraindicated the fenestration operation. In May 1943 a third audiogram was made.

M. A. R., aged 13, was referred in April 1939 with her twin sister because of diminished hearing. Menses had begun three years before. Measles occurred in early childhood without complication. There had been no suppuration of the ear at any time. Tinnitus was absent. The tympanic membranes were normal; there was a marked septal spur to the right, with fairly adequate breathing space bilaterally; the pharynx was granular; there were no adenoids, and the orifices of the eustachian tubes were free of lymphoid tissue. The teeth were normal. The child was in excellent health. Advice similar to that given for the other twin was given for this one. As compared with her twin sister, this child had fewer colds and less nasal blockage.

In January 1942 a second audiogram was made, and a month later her ears, nose and throat were reexamined. Tinnitus now was present in both ears, but the ears did not feel stuffy. The eustachian tubes were normally patent. Following inflation, there was no subjective improvement in hearing or tinnitus, while objectively the hearing was unchanged. Occasional colds seemed always to leave the hearing a little worse. Lip reading was advised as a precautionary measure, although both twins did acceptable school work without hearing aids. A third audiogram was made on May 7, 1943.

1. Fowler, E. P.: Studies of Deafness in Twins: Otosclerosis in Identical Twins; Three Case Histories, Arch. Otolaryng. **37**:275 (Feb.) 1943.

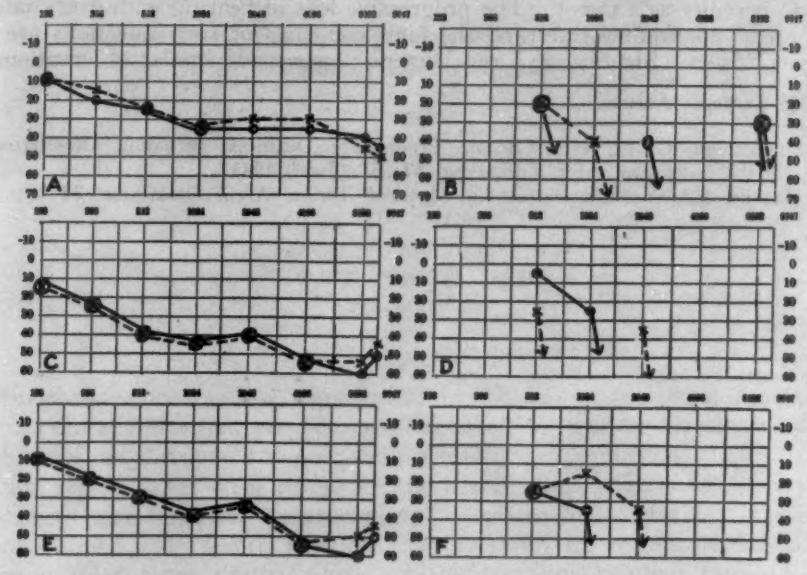

Chart 1.—Audiograms of S. J. R. The *o* curve represents the hearing in the right ear; the *x* curve that in the left ear. *A* records air conduction and *B* bone conduction on April 4, 1939, when the patient was 13; *C*, air conduction and *D* bone conduction on Jan. 24, 1942, when she was 16; *E*, air conduction and *F* bone conduction on May 7, 1943, when she was 17.

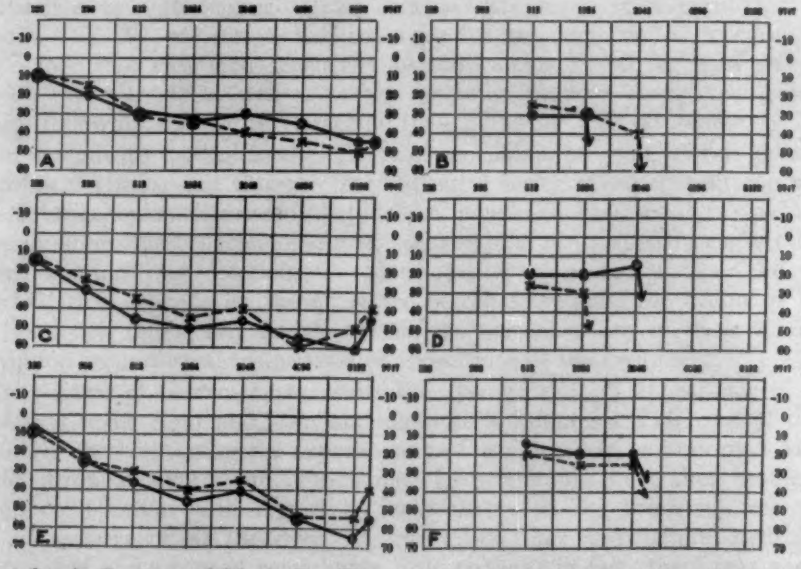

Chart 2.—Audiograms of M. A. R. The *o* curve represents the hearing in the right ear; the *x* curve that in the left ear. *A* records air conduction and *B* bone conduction on April 4, 1939, when the patient was 13; *C*, air conduction and *D* bone conduction on Jan. 31, 1942, when she was 16; *E*, air conduction and *F* bone conduction on May 7, 1942, when she was 17.

COMMENT

By inference the occurrence of a similar otosclerotic process in identical twins points to heredity as a factor. The progressive loss in hearing with every infection of the upper respiratory tract and the high incidence of such infections are noteworthy. Fowler,[1] Shambaugh [2] and Hagens [3] have made similar observations.

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2. Shambaugh, G. E., Jr.: Chronic Progressive Deafness, Including Otosclerosis and Diseases of the Inner Ear, Arch. Otolaryng. **37**:857 (June) 1943.

3. Hagens, E. W.: Otosclerosis in Identical Twins, Arch. Otolaryng. **34**:583 (Sept.) 1941.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

PERORAL ENDOSCOPY

LOUIS H. CLERF, M.D.
AND
T. T. SMITH, M.D.
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TECHNICAL STUDIES

Anesthetic Agents.—The employment of the newer anesthetic agents in the field of peroral endoscopic procedures often brings to light certain untoward effects which were not discovered during the preliminary experimental studies.

In a report based on a review of the literature as well as on their personal experiences with tetracaine (marketed as pontocaine hydrochloride), Thomas and Fenton [1] found that severe reactions had followed its employment in 7 cases. These included three deaths. Four of the reactions resulted from its use in preparation for or during bronchoscopic examination, and three followed its use in preparation for gastroscopic examination. Their experiences substantiated those of other workers regarding the character of the reactions and the correlation of symptoms in certain groups of persons, notably allergic patients, and also in persons without a definite history of allergy, such as emaciated patients.

Patch tests with tetracaine and cocaine were made on a number of allergic persons. Of 201 subjects tested, less than 0.5 per cent reacted to cocaine, while over 9 per cent exhibited sensitivity to tetracaine. From the data submitted it appears that allergic as well as severe systemic reactions occur with greater frequency following the use of tetracaine than following that of cocaine.

In a study to determine the effects of morphine, atropine and scopolamine on the bronchi Hibma and Curreri [2] carried out a series of experiments on a patient with a bronchopleurocutaneous fistula. A powdered carmine dye was placed in an easily accessible bronchial opening, and the time of its appearance in the expectorated sputum was determined. Since raising of secretion from the tracheobronchial tree depends on the character of the secretions, the action of the cilia and the cough reflex, any variation from the normal in any of these would cause a deviation from normal in the time of appearance of the carmine dye.

In a series of control experiments the average time of appearance of the dye was found to be eight and sixty-six hundredths minutes. This control time was frequently checked during the experiment and was found to be uniform. Morphine sulfate, atropine sulfate and scopolamine hydrobromide were then studied alone and in combination with regard to their effects on the bronchial tree and the time of appearance of the dye. It was found that scopolamine hydrobromide administered alone caused remarkably little change; in fact, there was a decrease

1. Thomas, J. W., and Fenton, M. M.: Fatalities and Constitutional Reactions Following the Use of Pontocain, J. Allergy **14**:145 (Jan.) 1942.

2. Hibma, O. V., and Curreri, A. R.: A Study of the Effect of Morphine, Atropine and Scopolamine on the Bronchi, Surg., Gynec. & Obst. **74**:851 (April) 1942.

in the time of appearance to 2.3 per cent under the control. Morphine sulfate administered alone caused an increase in the time of appearance to 11.6 per cent over the control. Atropine sulfate produced an increase in the time of appearance to 36 per cent over the control. The combination of morphine and scopolamine salts increased the time of appearance by 62.7 per cent while the morphine and the atropine salt in combination increased the appearance time by 107 per cent.

While there are many sources of error in this type of experiment, it is the finding for one medication as compared with that for another which is important rather than the time of appearance itself. The writers expressed the belief that the experiment corroborated what they had always considered to be clinically true, namely, that morphine and scopolamine given in individualized doses (the ratio here is 25 to 1) is a better preanesthetic combination than morphine and atropine.

In a study of the influence of vitamin C on the antihistamine action of various drugs and their effects on bronchioles, Ruskin [3] conducted experiments on a viable section of bronchiole obtained from the lung of a rabbit. The importance of the charts and the tables in interpreting the results of the investigation render it extremely difficult to contemplate a brief summary of this comprehensive study, and the reader therefore is referred to the original text in order that he may appreciate more fully the findings and significance of this excellent piece of experimental investigation.

Bronchoscopy.—The employment of a radiopaque substance for mapping the lung is now generally considered as an essential aid in the investigation of patients who cough and raise sputum. It is particularly important if surgical treatment is contemplated. Adams and Davenport [4] described a simple and almost uniformly successful technic which is suitable for general use. After the traceobronchial tree has been anesthetized and a catheter inserted, a series of positions is assumed by the patient as the injection proceeds, allowing filling of all bronchial subdivisions by gravity. By this means they were able to fill each lobe successfully.

The writers discussed the question of an adequate accepted bronchial nomenclature. They proposed a terminology which is believed to meet the practical needs of internists, radiologists, bronchoscopists and surgeons.

A new technic of bronchography in children was described by Field.[5] The patient is anesthetized with nitrous oxide, and a special intratracheal needle is inserted through the cricothyroid membrane. During the injection of the iodized oil no anesthetic is administered, since the best bronchograms are obtained with the patient fully conscious. The method is suitable for children of 5 years and over. For children under 5 years of age ether anesthesia induced by the open drop method is recommended.

BRONCHOSCOPY FOR DIAGNOSIS

In discussing the general subject of peroral endoscopy Friedberg [6] agreed that endoscopic measures are indispensable in accurate diagnosis and that they frequently offer the most practical and effective means of therapy in certain diseases of the lungs. If progress in the treatment of esophageal and bronchial carcinoma is to be anticipated, it will be necessary to carry out an early routine endoscopic

3. Ruskin, S. L.: Influence of Vitamin C on the Antihistamine Action of Various Drugs: Effect on Bronchiolar Reactions to Ephedrine, Epinephrine, Benzedrine and Calcium as Studied by Microscopic Observation, Arch. Otolaryng. **36**:853 (Dec.) 1942.

4. Adams, R., and Davenport, L. F.: The Technic of Bronchography and a System of Bronchial Nomenclature, J. A. M. A. **118**:111 (Jan. 10) 1942.

5. Field, C. E.: Bronchography in Children, Lancet **2**:357 (Sept. 26) 1942.

6. Friedberg, S. A.: Endoscopy in Diagnosis and Treatment of Diseases of Chest, Illinois M. J. **81**:212 (March) 1942.

examination in every patient who exhibits obscure thoracic signs and symptoms or disturbances in swallowing.

While bronchoscopy is seldom indicated in the treatment of diseases of newborn infants, there are rare occasions when it is a life-saving procedure. Woodward and Waddell [7] reported their results in a number of cases and found that it is of value in certain cases of atelectasis due to obstruction of the bronchi by body secretions. While the procedure should not be undertaken too lightly or too hastily, if properly sized bronchoscopes are employed, no ill effects will be observed.

The indications for bronchoscopy in newborn infants are not clearcut, and the decision therefore must be made in the individual case only after careful consideration by the pediatrician and the bronchoscopist. In view of its employment with safety it seems that the method could be utilized more frequently in cases in which the indications are definite and positive.

HEMOPTYSIS

The relative frequency of hemoptysis as a symptom of bronchopulmonary disease other than tuberculosis and the importance of bronchoscopy as one of the diagnostic means to determine its origin are recognized by physicians. While tuberculosis still continues to be responsible for a large number of cases of hemorrhage the occurrence of this symptom in bronchiectasis, pulmonary neoplasm and many other nontuberculous processes is being more clearly recognized.

In an investigation of this subject Jackson and Diamond [8] studied a group of 436 patients. Only those who had a careful physical examination, a roentgenologic study and at least one bronchoscopic exploration were included. Inflammatory processes were found responsible for the hemorrhages in a majority of the subjects, the most common etiologic agent being bronchiectasis. Bronchial dilatations were demonstrated in more than one third of the patients who had massive hemoptysis and in fully two thirds of those whose initial attack of blood spitting occurred before they were 20 years of age. In a study of the relative hemorrhagic tendencies of various nontuberculous bronchopulmonary lesions it was found that expectoration of blood occurred actually in a smaller percentage of bronchiectatic patients than of patients with primary carcinoma of the bronchus, pulmonary abscess or bronchial adenoma. Fatal hemoptysis occurred in but 3 patients in the series, each of whom had a pulmonary abscess.

A hemorrhagic focus could be seen on bronchoscopic examination in 25 per cent of the patients. Nearly all of the neoplasms causing hemoptysis arose in major bronchi and thus were readily apparent bronchoscopically. In only a small number of inflammatory lesions, however, was it possible to detect a definite bleeding point. There was no endoscopic evidence of recent or active bleeding from a vascular lesion in the tracheobronchial tree in any of the patients. The precise cause of the hemoptysis could not be determined in nearly one fourth of the patients. These were patients in whom no parenchymal disease was demonstrable on roentgenographic examination and no bleeding point on bronchoscopy. The likelihood that ulcerating lesions were present in the smaller bronchi of these patients must be considered.

Despite the fact that in fully 90 per cent of the patients with hemorrhagic bronchial cancer the neoplasm was situated in one of the larger, bronchoscopically accessible bronchi and that bronchoscopy was performed in these patients soon

7. Woodward, F. D., and Waddell, W. W., Jr.: Bronchoscopy in the Newborn, Ann. Otol., Rhin. & Laryng. **51**:1094 (Dec.) 1942.

8. Jackson, C. L., and Diamond, S.: Hemorrhage from the Trachea, Bronchi and Lungs of Nontuberculous Origin, Am. Rev. Tuberc. **46**:126 (Aug.) 1942.

after the occurrence of the first episode of spitting blood, the process was found to be far too advanced to permit surgical cure in any patient but one. Taking into consideration the fact that expectoration of blood is the initial manifestation of carcinoma of the bronchus in only a small percentage of patients, it is obvious that bronchoscopy must be done and the diagnosis made early in the course of the disease, before the symptoms have reached the hemoptysic stage, if a successful therapeutic result is to be achieved in these cases.

Hemoptysis is a common symptom and may occur with many different lesions. Parrish [9] divided these into two main groups, namely, those arising in the respiratory tract or lung structure and those arising outside the respiratory tract which by growth or other means invade the respiratory tract. A third group might also be considered, namely, traumas, either direct or indirect, involving the respiratory tract or the lung structure. While in many cases the cause and the location of the bleeding can be readily determined, in others they may be found with difficulty or may be discovered only at autopsy.

In the more obscure cases bronchoscopic examination often is resorted to as a diagnostic aid. All available diagnostic measures should be carried out, however, before bronchoscopy is performed since certain of these cases can be diagnosed by physical examination and roentgen study of the chest. In addition, careful blood studies should be done. Parrish agreed that a small hemorrhage is not a contraindication to bronchoscopy; in fact, a small amount of blood in the tracheobronchial tree at the time of examination may be of distinct aid in localizing the bleeding point. If the hemorrhage is great, however, bronchoscopy is of limited or often of no value since the quantity of blood interferes with a satisfactory view of the bronchi.

Three cases are reported. In the first the cause of hemoptysis was unusual, the final diagnosis being subdiaphragmatic abscess which had ruptured into the pleural space and had subsequently drained through a bronchus. In the second case several bronchoscopic examinations were performed, and blood was found coming from the lower lobes of both lungs. Further studies failed to reveal any possible cause for this, and the final diagnosis was hemorrhage from the respiratory tract, the location and the cause being uncertain. In the third case there was a history of injury, the patient having a copious pulmonary hemorrhage while lifting a heavy weight. Studies were instituted, and bronchoscopic examination was performed. Mild granular changes in the mucosa of the right main bronchus were noted, and these bled slightly when touched with the bronchoscope, but it was not believed that this was the source of the bleeding. The patient ultimately died, and permission for a postmortem study was secured. The final diagnosis was nonspecific bronchitis with erosions of the mucosa and nonspecific hyperplastic lymphadenitis. No demonstrable source of bleeding was observed.

ACUTE LARYNGOTRACHEOBRONCHITIS

In recent years much stress has been put on the treatment for infectious types of laryngotracheobronchitis. In the opinion of Gittins [10] this has overshadowed the question of differential diagnosis. It has, however, added materially to a fairly well standardized plan of treatment, with the result that the mortality rate has unquestionably been reduced. Attention is directed to the traumatic and the allergic types of laryngotracheobronchitis. While these usually do not

9. Parrish, R. E.: Hemorrhage of the Respiratory Tract: A Bronchoscopic Problem, Ann. Otol., Rhin. & Laryng. **51**:1111 (Dec.) 1942.

10. Gittins, T. R.: Laryngotracheobronchitis in Children, Arch. Otolaryng. **36**:491 (Oct.) 1942.

terminate fatally, it is important to distinguish between them and the infectious types. Gittins directed attention to the traumatic type which commonly suggests the presence of a foreign body in the respiratory tract. In a group of 13 cases careful studies, including bronchoscopy, failed to reveal a demonstrable foreign body although in each instance there was a fairly definite history of sudden onset, with choking, stridor, cough, wheezing and cyanosis, and there also was a history of some materials, notably foods, having been found in the mouths of these children when the symptoms of acute respiratory distress developed. It is probable that fragments of food too small to be identified bronchoscopically were present in these cases and had been drawn deep into the smaller bronchial subdivisions or got rid of in the bronchial secretions. Complete recovery occurred in all 13 cases without sequelae.

In discussing laryngotracheobronchitis Troup and Weaver[11] stressed the importance of cooperation by all engaged in the treatment of the patients. The disease in its typical fulminating form occurs most often in children under 2 years, and in these the mortality rate is high. In older children the infection is not so severe. The results of treatment depend on early diagnosis, and therefore internists and pediatricians should be familiar with the clinical, bronchoscopic and pathologic phases of the disease. The mild form usually responds to an adequate intake of fluids, inhalations of steam and oxygen therapy. In the severe cases tracheotomy, prevention of crusts in the trachea and bronchi by humidification, maintenance of an adequate intake of fluids and mechanical removal of secretions and crusts are indicated.

POSTOPERATIVE PULMONARY ATELECTASIS

In order to determine the relative incidence of infections of the respiratory tract after inhalation and spinal anesthesia in patients who had no preoperative infections of the respiratory tract and who had undergone some type of abdominal operation, Lyford[12] studied a series of 631 cases. All patients when operated on were under anesthesia induced with ether or with cyclopropane or spinal anesthesia and all were without infection of the respiratory tract at the time of operation. A small proportion of patients without respiratory infection at the time of operation acquired postoperative infection of the respiratory tract with inhalation and with spinal anesthesia. The incidence was 5.8 per cent with ether anesthesia, 4.9 per cent with cyclopropane anesthesia and 7.5 per cent with spinal anesthesia. The incidence of postoperative respiratory infections appeared unaffected by the age or the sex of the patients, the preoperative complications, the length of the operative anesthesia, the kind or the amount of spinal anesthetic agent or preanesthetic medication or the blood pressure changes during the anesthesia.

In an attempt to determine the course of infections of the respiratory tract after anesthesia induced with ether or with cyclopropane and spinal anesthesia in patients who had been known to have low grade chronic preoperative infections of the respiratory tract not generally considered by surgeons to be contraindications to elective operations, Lyford[13] studied 120 cases. In these it was observed that the incidence of acute infections rose very appreciably. The incidence for

11. Troup, W. J., and Weaver, D. F.: Laryngotracheobronchitis, Wisconsin M. J. **41**:21 (Jan.) 1942.

12. Lyford, J.: Postoperative Infections of Respiratory Tract in Relation to Inhalation and Spinal Anesthesia: Study of Six Hundred and Thirty-One Cases, Arch. Surg. **44**:35 (Jan.) 1942.

13. Lyford, J.: Preoperative and Postoperative Infections of Respiratory Tract in Relation to Inhalation and Spinal Anesthesia, Arch. Surg. **44**:41 (Jan.) 1942.

ether anesthesia was 13.5 per cent, that for cyclopropane anesthesia 17.5 per cent and that for spinal anesthesia 39.5 per cent.

The importance of emptying the tracheobronchial tree completely of secretions at the end of operation cannot be overemphasized. This is particularly true in thoracic surgery. In discussing this subject Bird [14] emphasized the need for bronchoscopic aspiration and pointed out the advantages of immediate aspiration, completed before the recovery of the cough reflex. He enumerated these as follows: The procedure prevents sucking or driving of foreign material into lobes or lobules by hyperventilation or ineffective coughing. It favors the reexpansion of collapsed segments of lung when positive pressure is applied by mask and negative pressure is exerted within the pleural space. It allows patients to lie flat and on the side instead of in the Trendelenburg position, and in this way conserves vital capacity. It minimizes exhausting cough, thus lessening circulatory strain and allowing the patient more complete rest.

The possible disadvantages are that the anesthesia might have to be deepened in order to carry out the bronchoscopy, and in untrained hands bronchoscopy itself might be damaging. In a few cases if secretions reaccumulate rapidly, tracheotomy is indicated, so that aspirations may be repeated at short intervals with little disturbance. Reports of results obtained in 22 patients in whom aspiration was practiced as required are included in the article and form the basis for the views expressed by the author.

An analysis of the origin of postoperative pulmonary complications makes it appear that some are avoidable while others are beyond the control of the surgeon or the anesthetist. In an investigation of this subject Eggers [15] emphasized certain preventive measures which should be observed. If in spite of these a complication threatens or develops, active therapeutic measures should be promptly instituted. One of the most important is ridding the patient of excessive secretions in the pharynx and the bronchial tree. If simple measures prove ineffective, it may be necessary to resort to intratracheal suction or bronchoscopic aspiration. If it is suspected that coarse particles of infected material have been aspirated, a bronchoscopic examination should be made immediately after operation. Bronchoscopy also is to be preferred if the entire bronchial tree is filled with secretion, since it permits complete aspiration of the larger bronchi.

Atelectasis is the most commonly encountered pulmonary complication following abdominal operation. In a study of this subject Schmidt and others [16] found that it occurs almost always as the result of decreased pulmonary ventilation and inadequate bronchial drainage. The effects of the anesthetic agent on the patient, the position of the patient at the time of operation and the type of operation play important roles in the causation. In their opinion bronchoscopic aspiration is useful in the prevention as well as in the treatment of postoperative atelectasis.

A series of 84 selected cases are reported. There were 58 men and 26 women. Nothing was observed roentgenologically before operation by which the likelihood of the occurrence of atelectasis could have been foretold. If treatment was started within forty-eight hours after the complication occurred, the results were excellent, whereas if it was started seventy-two hours or more

14. Bird, C. E.: Aspiration of the Lower Air Passages Following Endotracheal Anesthesia, J. Thoracic Surg. **12**:44 (Oct.) 1942.

15. Eggers, C.: Prevention and Treatment of Postoperative Pulmonary Complications, New York State J. Med. **42**:2293 (Dec. 15) 1942.

16. Schmidt, H. W.; Mousel, L. H., and Harrington, S. W.: Postoperative Atelectasis, J. A. M. A. **120**:895 (Nov. 21) 1942.

after the complication had developed, recovery was slower, since secondary pneumonia often had developed.

While the mortality of postoperative atelectasis itself is low, the condition may be complicated by bronchopneumonia and thus either terminate fatally or have serious sequelae.

McCall and Freeman [17] reported their results in 4 cases and emphasized the importance of early recognition of the condition, since this permits prompt application of therapeutic measures, with early return of function to the atelectatic lung and prevention of the serious complications and sequelae. They agreed that bronchoscopic aspiration is the most satisfactory method of removing bronchial secretions, which were the cause of the atelectasis in their cases.

Pulmonary atelectasis the result of obstruction of a bronchus is not an uncommon finding bronchoscopically. Experimental studies by de Takáts and others [18] indicate that reflex pulmonary atelectasis may occur in the absence of any gross bronchial obstruction, such as that caused by a foreign body or by secretions. As a result of animal experiments and correlated clinical observations it was their opinion that bronchial obstruction may be initiated by early bronchomotor and bronchosecretory phenomena, which may subsequently result in mechanical obstruction. If this is not relieved, parenchymal damage will result. They found that the bronchial tree is capable experimentally of definite contraction and production of secretions immediately after pulmonary embolism. Studies showed that bronchial obstruction with subsequent atelectasis is a factor in the production of the clinical and roentgen findings of pulmonary embolism. Additional data suggest that reflex atelectasis may occur from sources other than pulmonary embolism.

BRONCHIAL ASTHMA

In a review of recent reports in the literature of deaths due to status asthmaticus and in a study of 6 or 7 patients who died of status asthmaticus and on whom autopsy was performed, Bases and Kurtin [19] found that death had resulted from blocking of the tracheobronchial airway by an excessive outpouring of secretion. The secretion, because of its thick, tenacious mucoid character, produced partial or complete obstruction of the tracheobronchial tree in a majority of the cases. In the opinion of the writers bronchoscopic aspiration of the obstructing secretion will serve as a life-saving measure in those patients suffering from progressive respiratory infection in whom asphyxiation is imminent.

Death from acute intractable asthma is quite rare. Vaughn and Graham [20] have observed eight such deaths among several thousand asthmatic patients whom they examined. The administration of opiates in this group of cases is widely recognized as dangerous and is definitely contraindicated since these drugs depress the central nervous system, including the respiratory center, and increase respiratory difficulty. In addition, they exert a slight but definite bronchospastic effect, which is precisely what one is trying to avoid in the treatment of asthma.

Opiates should be avoided in the treatment of severe asthma, especially when other agents such as the ephedrine derivates, epinephrine and theophylline ethylene-

17. McCall, J. W., and Freeman, M. S.: Postoperative Atelectasis: Presentation of Four Cases, Ohio State M. J. **38**:546 (June) 1942.

18. de Takáts, G.; Fenn, G. K., and Jenkinson, E. L.: Reflex Pulmonary Atelectasis, J. A. M. A. **120**:686 (Oct. 31) 1942.

19. Bases, L., and Kurtin, A.: Prevention of Death in Status Asthmaticus: Value of Bronchoscopy, Arch. Otolaryng. **36**:79 (July) 1942.

20. Vaughn, W. T., and Graham, W. R.: Death from Asthma: A Warning, J. A. M. A. **119**:556 (June 13) 1942.

diamine are far superior. Even when these fail, morphine and its derivates should not be used. Supplementary drugs such as digitalis should not be employed unless the need for them has been clearly established. Bronchoscopy may occasionally be life saving. Reference is made to the case of a patient, apparently moribund, who made a rather prompt recovery following bronchoscopic removal of secretions from the tracheobronchial tree.

Although considerable research has been conducted on the subject of chronic allergic asthma, certain pathologic and physiologic phases still cannot be adequately explained. Van Loon and Diamond [21] observed bronchoscopically 100 children with chronic allergic asthma. No evidence of bronchospasm or bronchoedema was observed in any of the patients. Nonspecific inflammatory changes were present in 91. Accentuation of the physiologic expiratory narrowing of the tracheobronchial tree was noted in 36. Mucopurulent or thick mucoid secretion was found in 60. There was no characteristic pathologic picture. Lobar or segmental atelectasis was not observed in any of the children. Of 20 patients in whose bronchi iodized oil was instilled, 5 were shown to have bronchiectasis. The only constant feature of the bronchoscopic appearances was the presence of thick, viscid secretions in the tracheobronchial tree (intraluminally).

TRACHEAL ECTASIA

Tracheal ectasis is unusual. In the case reported by Priest [22] a swelling on the right side of the patient's neck immediately above the clavicle could be produced at will by closing the glottis and straining. Roentgen studies of the neck revealed marked dilatation of the trachea on forced expiration. Papilloma involving the subglottic larynx was found, and the question arose whether it might not have been sufficient to stimulate the cough reflex and probably should be considered as an etiologic factor in the development of the tracheal dilatation.

BRONCHIAL TRAUMA

Injury of the thoracic wall with crushing or actual section of a main bronchus is of rare occurrence and is nearly always fatal. Tyson and Lyle [23] reported the case of a patient who sustained an injury of the chest in an automobile accident. Subsequent bronchoscopy and bronchography demonstrated that the left main bronchus terminated blindly and that the blind end was lined by normal bronchial mucosa. It was of interest to note that there was complete absence of infection in the atelectatic lung. They ascribed this to the fact that the obstruction was complete and probably prevented contamination of the lung distal to it. In experimental studies infection had been encountered with partial bronchial obstruction and not observed when obstruction was complete. The writers briefly reported on the cases recorded in medical literature and discussed certain physiologic aspects of the condition.

ABSCESS OF THE LUNG

In a discussion of abscess of the lung Janes [24] expressed the opinion that bronchoscopy is of value in the recognition and diagnosis of the lesion. In some

21. Van Loon, E. L., and Diamond, S.: Bronchoscopic Aspects of Asthma in Children, Am. J. Dis. Child. **63**:217 (Feb.) 1942.

22. Priest, R. E.: Tracheal Ectasis with Report of a Case, Ann. Otol., Rhin. & Laryng. **51**:1055 (Dec.) 1942.

23. Tyson, M. D., and Lyle, J. S.: Traumatic Obstruction of a Main Bronchus: Report of a Case, New England J. Med. **226**:192 (Jan. 29) 1942.

24. Janes, R. M.: Abscess of the Lung, Canad. M. A. J. **47**:540 (Dec.) 1942.

cases it may improve drainage, but because of the pathologic changes present it can do little more. In his opinion repeated bronchoscopic treatment should not be considered as a substitute for more effective treatment.

Abscess of the lung is a serious disease which under the generally accepted plans of medical treatment has a high mortality rate. In a discussion of the subject Bradford [25] emphasized the importance of postural drainage and also indicated that bronchoscopy had several valuable functions. It aids in diagnosis and localization by visualization of the tracheobronchial tree. By this means it is possible to remove obstructing material from a bronchus and also to aspirate purulent secretions. It is his opinion, however, that any pulmonary abscess requiring repeated bronchoscopic aspiration should be treated surgically.

BRONCHIECTASIS

In a study concerning the relationship of atelectasis and bronchiectasis Tannenberg and Pinner [26] carried out experiments on animals. There is every reason to believe that the results obtained have a definite bearing on the understanding of bronchiectasis in man. For this reason their summary is of importance.

Pulmonary atelectasis as produced by obstruction from within or by bronchial ligation in rabbits may be present for periods up to several months without complications in the affected lung if no infection supervenes.

Uncomplicated pulmonary atelectasis per se does not tend to dilate the bronchi. The same force that brings about atelectasis also causes collapse and contraction of the bronchi. Increase in the negative intrapleural pressure on the side of the atelectatic lung does not dilate the bronchi of the atelectatic lung.

Experimentally all degrees of bronchiectasis from slight cylindric to most severe saccular forms were produced when infections occurred in the bronchial tree of a lung, in which bronchi were completely or almost completely occluded. An infection that produced a purulent inflammation of the bronchi and only a desquamative pneumonic exudate in the alveoli was most likely to cause severe bronchiectasis. The severest bronchiectasis occurred within a period of about four weeks after the onset of infection. If the period of survival was several months, the bronchiectasis was of a more moderate degree. Following partial obstruction of the bronchial tree of a lung, patchy atelectasis, overinflation and emphysema of the lung occurred, but no bronchiectasis was observed.

It was concluded from these experiments that bronchiectasis is caused by inflammatory infiltration of bronchial walls with accumulation of exudate in the bronchial lumens; the exudate is prevented from draining because of the artificially produced bronchial obstruction.

In a study of the various clinical aspect of bronchiectasis in children Diamond and Van Loon [27] selected a group of 75 patients with bronchiectasis and for contrast an equal number with similar symptoms but normal bronchographic appearances. Comparative studies were made on the age of the patient, the onset of symptoms, the antecedent factors, the extent and the distribution of the pulmonary involvement, the relation of symptoms to the presence and the extent

25. Bradford, J. K.: Treatment of Lung Abscess, Virginia M. Monthly **69**:329 (June) 1942.

26. Tannenberg, J., and Pinner, M.: Atelectasis and Bronchiectasis: An Experimental Study Concerning Their Relationship, J. Thoracic Surg. **11**:571 (Aug.) 1942.

27. Diamond, S., and Van Loon, E. L.: Bronchiectasis in Childhood, J. A. M. A. **118**:771 (March 7) 1942.

of the bronchiectasis and the relation between the extent of the roentgenographic and bronchoscopic findings and the extent of the bronchiectasis. A determination of the bacteriologic flora in the bronchoscopically aspirated secretions of the entire group also was presented.

From the series studied they expressed the opinion that symptomatic improvement in children with bronchiectasis could be attained by conservative therapy in most cases. Active progression in the size of the dilatation is not common during childhood. The essential feature of a nonsurgical regimen of treatment is control of the infection in the bronchi and in other parts of the respiratory tract. In spite of the symptomatic benefit resulting from conservative therapy, in not a single instance did it represent an anatomic cure, and obviously the outlook in bronchiectasis without operative intervention is exceedingly dark.

In discussing bronchiectasis in children Wishart [28] expressed the opinion that bronchoscopy together with bronchoscopic suction, injection of iodized oil under general anesthesia and bronchography have proved of unquestioned benefit in the study and treatment of this condition. During the past thirteen years 433 cases of bronchiectasis have been diagnosed, and 1,015 records of these cases have been studied. The iodized oil is introduced into the lung by means of bronchoscopy under general anesthesia. Bronchography has been done on patients under 2 years of age and suction on patients under 1 year of age without any complication.

These preliminary studies disclosed the cases in which major surgical treatment was contraindicated and also determined those in which the only known cure, namely, major surgical extirpation of the diseased lung, was suitable. Bronchoscopy provided the most effective form of treatment for the large group of patients who do not require major surgical treatment. Bronchography permits an early definite diagnosis of the disease and therefore affords hope that further progress of a most devastating disease can be checked.

Pulmonary suppuration commonly is secondary to specific pulmonary disease. Vinson [29] emphasized the importance of directing therapeutic measures toward the primary lesion, for with its removal the secondary suppurative process often subsides spontaneously. A number of conditions were discussed. Any patient with pulmonary suppuration should have at least one bronchoscopic examination for accurate determination of the location and distribution of the area of infection. When bronchial stricture is present, adequate drainage often can be provided by bronchoscopic methods with beneficial or curative results. He has found that bronchoscopic aspiration of the tracheobronchial tree followed by insufflation of powdered sulfanilamide has benefited patients with chronic suppuration.

Interference with normal drainage of the esophagus commonly results in overflow of secretions and foods into the tracheobronchial tree and development of pulmonary symptoms. Hill [30] reported on the progress of 2 patients with pulsion diverticulum of the esophagus complicated by pulmonary suppuration. One had an abscess of the lung which required external drainage. The other had pneumonitis, probably from aspiration of lipoid substances, in which a satisfactory result was secured following surgical treatment of the diverticulum.

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28. Wishart, D. E. S.: Bronchoscopy in Diagnosis and Treatment of Bronchiectasis in Children, J. A. M. A. **120**:1181 (Dec. 12) 1942.

29. Vinson, P. P.: Management of Chronic Suppurative Pulmonary Disease, Virginia M. Monthly **69**:7 (Jan.) 1942.

30. Hill, F. T.: Pulmonary Suppuration Secondary to Esophageal Diverticulum, J. Maine M. A. **33**:99 (May) 1942.

TUBERCULOSIS OF THE TRACHEA AND BRONCHI

In discussing primary tuberculosis in children Jones and others [31] referred to the group of patients whose condition has been called epituberculosis and those with a type of bronchial obstruction that often is considered as extensive pulmonary tuberculosis or tuberulous pneumonia. It is their opinion that bronchial obstruction with atelectasis forms the basis for many of the conditions that often are considered as tuberculous pneumonia. Bronchoscopic studies were carried out on a group of 42 children to determine the presence of bronchial obstruction due in all probability to extrabronchial lesions. They found multiple lobar involvement in some, variation from normal in the size of a lobe in several and enlargement of the tracheobronchial lymph nodes in nearly all. Tissue removed for biopsy in 9 instances revealed definite tuberculosis. They found that atelectasis occurred in children with primary tuberculosis more frequently than was commonly believed and that this should always be borne in mind with children whose roentgen films show a dense homogeneous shadow. In view of these findings it was suggested that the indefinite and confusing term "epituberculosis" is no longer required and should be abandoned.

To determine whether bronchiectasis developed as a sequela of pulmonary atelectasis occurring in the course of the childhood type of tuberculosis, Kent [32] studied a series of 10 children who exhibited lobar atelectasis during the course of such tuberculosis. The bronchial occlusion in these was the result of external pressure from caseating peribronchial lymph nodes. Secondary bronchiectasis was shown to be present in 7 of the 10 children and was believed to be the result of this bronchial obstruction. He considered the prognosis favorable. These cases afforded additional evidence that the so-called epituberculous pneumonia is in reality atelectasis resulting from occlusion of a bronchus.

In a report on tuberculous tracheobronchitis and on observations carried out on 6 patients, 5 of whom were females, Menendez and Gonzalo [33] emphasized the importance of the typical asthmatoid syndrome which commonly is observed in cases of this condition. While "tuberculous asthma" does occur, and asthma and tuberculosis may arise independently in the same patient, they emphasized the importance of considering bronchial tuberculosis in every patient who is found to have localized rhonchi and wheezing respiration.

The diagnosis can be established with certainty only by bronchoscopy, although certain of the clinical and roentgenologic signs are suggestive, and stenotic lesions can be diagnosed by bronchography. One cannot, however, be certain with these methods whether the lesion is ulcerogranulomatous or whether cicatrization has occurred. Parenchymal lesions do not contraindicate bronchoscopic examination except in very special cases, and complications are rare. Biopsy probably is contraindicated if the bronchial lesion is suspected to be tuberculous in origin. In patients under treatment by any type of collapse therapy the persistence of positive sputum in spite of an apparently effective plan of therapy should lead one to suspect the presence of an ulcerated lesion of the bronchus, and the bronchoscopic examination should be performed.

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31. Jones, E. M.; Rafferty, T. N., and Willis, H. S.: Primary Tuberculosis: Complicated by Bronchial Tuberculosis with Atelectasis (Epituberculosis), Am. Rev. Tuberc. **46**:392 (Oct.) 1942.

32. Kent, E. M.: Bronchial Obstruction and Pulmonary Atelectasis as Seen in Childhood Tuberculosis with Secondary Bronchiectasis as a Sequela, Am. Rev. Tuberc. **46**:524 (Nov.) 1942.

33. Menendez, F. J., and Gonzalo, P. H.: Tuberculous Tracheobronchitis, Dis. of Chest **8**:382 (Dec.) 1942.

Phelps [34] recorded certain observations on a series of 67 patients with endobronchial tuberculosis, 65 of whom were women and 2 men. He agreed that tuberculosis is rarely primary in a bronchus. He does not recommend bronchoscopy as a routine procedure in all cases of tuberculous involvement. His patients were carefully selected, and bronchoscopy was performed because bronchial lesions were suspected. In his experience the bronchoscopic diagnosis corroborated the clinical and the roentgen diagnosis of bronchial tuberculosis in about 75 per cent of the cases. In the presence of positive clinical and roentgen findings a negative result of bronchoscopy simply means that the disease is beyond the field of bronchoscopy.

While there is considerable difference of opinion regarding the best plan of treatment, the local application of silver nitrate in 30 per cent concentration has been found beneficial. Removal of granulation tissue with forceps has been performed, although it is realized that complete removal is impossible; the improvement in the airway has resulted in better drainage. Local treatment of fibrotic stenosis by dilation has not been satisfactory. It is interesting to note that bronchiectasis was found in 80 per cent of the cases and probably was present in a larger proportion. It unquestionably is the result of infection of the bronchial walls and probably is tuberculous in origin.

There appears to be considerable difference of opinion regarding the plan of therapy to be employed bronchoscopically for tuberculous tracheobronchitis. This is in great part due to the recent acquisition of present knowledge concerning this condition and also to the fact that adequate time has not elapsed to permit evaluation of therapeutic agents and arrival at final conclusions.

In a study of this subject Clerf [35] found that ulcers were commonly treated by some form of cauterization. He preferred the use of silver nitrate, preferably in 5 or 10 per cent solution. It is believed that strong solutions might induce additional cicatrization. Electrosurgical cauterization and electrocoagulation have been employed, but the results have been rather variable, and it is therefore difficult to arrive at conclusions. Extensive cauterization should be avoided because of the tendency toward scarring. Mechanical removal of granuloma is inadvisable unless the lesion is pedunculated, single and obstructive. He expressed the opinion that the important consideration in the treatment of tuberculous tracheobronchitis is dependent on systemic measures together with collapse therapy if there is little or no bronchial obstruction and no serious impairment of drainage.

In reporting his experiences in 500 bronchoscopic examinations of tuberculous patients Conklin [36] emphasized the value of bronchoscopy in cases of tuberculosis from the standpoint of diagnosis as well as treatment. The contraindications are few, and complications should be rare. The incidence of tracheobronchial lesions in patients with tuberculosis unquestionably is higher than is generally believed. If bronchoscopy were done routinely, the incidence probably would be found to be higher. It is a question whether these lesions are of such grave prognostic significance as has been previously thought.

Conklin recommended that diagnostic bronchoscopy be carried out as a routine in institutions for tuberculous patients in order that the understanding of tuberculous tracheobronchitis may be improved and that the most rational management of cases of pulmonary tuberculosis in which this complication occurs may be determined. He found topical application of silver nitrate in 10 to 25 per cent solution useful in tuberculous ulceration of the trachea and bronchi.

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34. Phelps, K. A.: Further Observations on Tuberculous Endobronchitis, Ann. Otol., Rhin. & Laryng. **51**:1103 (Dec.) 1942.
35. Clerf, L. H.: Tuberculous Tracheobronchitis, Dis. of Chest **8**:356 (Nov.) 1942.
36. Conklin, W. S.: Tuberculous Tracheobronchitis, Dis. of Chest **8**:172 (June) 1942.

The tracheobronchial tree was examined by careful dissection and microscopic study in 10 consecutive cases by Perez,[37] in all of which death was due to advanced pulmonary tuberculosis. Tuberculous changes were found in the trachea, the main bronchi and the stem bronchi in 9 of the 10 cases. Small bronchi draining tuberculous areas were all involved.

In a study of 52 patients with tuberculous tracheobronchitis Cutler[38] found wheezing in 90 per cent. While tuberculous tracheobronchitis may occur at any age, it was found more commonly in the age group under 35, and 80 per cent of the patients in this series were females.

Atelectasis appeared to be observed more often with lesions of the non-ulcerated type, due probably to edema and prolonged spasm of the bronchioles. Of the 52 patients, 44 were found to have bronchial ulceration; the lesions of 24 of these were healed by electrocoagulation, which was done at intervals of from two to four weeks. The lesions of the remaining 20 were reported unhealed. Of the latter group, 6 died from their pulmonary disease, 14 were unimproved, 8 still were under treatment and the remaining 6 had been given but one bronchoscopic treatment because of the poor prognosis. Cutler expressed the belief that conservative treatment should be practiced by withholding collapse therapy until the bronchial ulcers were healed, especially in cases of minimal involvement. Lobectomy or pneumonectomy is the procedure of choice if stenosis is complete.

In a review of 100 consecutive cases of endobronchial disease complicating pulmonary tuberculosis Chamberlain and Gordon[39] agreed that endobronchial tuberculosis is essentially a problem of mechanical obstruction in a patient with pulmonary tuberculosis. Obstructive emphysema, bronchiectasis and atelectasis are frequent complications of this disease. The management of the patients must therefore be based on one's understanding of the physiopathology of bronchial obstruction. While endobronchial tuberculosis tends to run a self-limited course, one usually cannot hope to treat it through control of the parenchymal lesion alone, since the stenosis may be sufficient to interfere seriously with the respiratory and cleansing mechanism of the lung and lead to certain irreversible complications, such as emphysema, atelectasis and bronchiectasis.

Early bronchoscopic recognition of the bronchial disease and reduction in the size of the pulmonary bed before chronic stenosis occurs are of fundamental importance in the therapeutic program. Topical applications of a solution of silver nitrate will often aid therapy directed toward healing of the pulmonary lesion. When large bronchi are involved and the bronchial disease is severe, pneumothorax is a dangerous form of therapy. Some permanent form of therapy is commonly indicated, and the writers reported that the results from thoracoplasty have been good and that external drainage, lobectomy and pneumonectomy may be used in selected cases.

Much of the controversy concerning the management of associated pulmonary and tracheobronchial tuberculous lesions centers about the wisdom of collapse measures for the pulmonary process and the value or the need of treatment for the tracheobronchitis. Elwood and others[40] expressed the belief that bronchoscopic

37. Perez, J. A.: Tuberculosis of Trachea and Bronchi, Journal-Lancet **62**:138 (April) 1942.

38. Cutler, I. L.: Wheezing, Bronchial Ulcers and Atelectasis, Dis. of Chest **8**:79 (March) 1942.

39. Chamberlain, J. M., and Gordon, J.: Treatment of Endobronchial Tuberculosis: A Review of One Hundred Cases, J. Thoracic Surg. **11**:292 (Feb.) 1942.

40. Elwood, B. J.; Potter, B. P.; Sacco, A. G., and Pagliughi, J. J.: Importance of Control of a Pulmonary Lesion When Tuberculous Tracheobronchitis Coexists, Arch. Otolaryng. **35**:408 (March) 1942.

treatment should aim to alleviate distressing symptoms and facilitate the drainage of exudate from the distal bronchopulmonary bed. While no definite proof of the effectiveness of topical measures is available, it is their impression that, while spontaneous healing may take place, it has been hastened in a significant number of cases and distressing symptoms have been alleviated by endobronchial procedures.

In a statistical study of 92 patients who had tuberculous stenosis of the major bronchi, Tuttle and others [41] found that local treatment with a 30 per cent solution of silver nitrate achieved some success. Seventy per cent of the ulcerated lesions healed, resulting in healed stenosis. In their experience silver nitrate tended to increase the size of the bronchial lumen by the removal of granulation tissue. Dilation of a stenosed bronchus is only a palliative measure. The dilated structure remains open for varying periods, in many instances not more than a few days to a few weeks. The main virtue of dilation rests on its ability to relieve the immediate obstruction, and by repeated use coupled with aspiration of secretions beyond the point of stenosis the condition of the distal bronchi often improves so that secretions become less in amount and thin enough to pass through the stenotic bronchus without difficulty.

In their experience thoracoplasty has yielded better results than pneumothorax in patients with marked degrees of stenosis. Bronchoscopic dilation of the stenosed bronchus carried out a few days preceding the operative procedure usually is sufficient to maintain an adequate bronchial lumen during the immediate postoperative stage. Only in a few instances was bronchoscopy necessary to remove secretions in the first few postoperative days.

With the more general employment of bronchoscopy in the study of patients suffering from tuberculosis, a higher incidence of tuberculous lesions of the trachea and bronchi has been revealed. Although many of the superficial lesions do heal without treatment, it is not uncommon to observe obstruction of a bronchus as a result of fibrosis. There is considerable difference of opinion as to the type of treatment that should be employed. Durkin and Vinson [42] reported an excellent result from irradiation of a tuberculous stricture of the bronchus. When the patient was examined five years later, he had no evidence of bronchial occlusion, was completely free from pulmonary symptoms and had gained 35 pounds (16 Kg.) in weight.

The increasing employment of bronchoscopy in the study of tuberculous patients has revealed a significant percentage of pulmonary lesions complicated by endobronchial lesions. In discussing rapid reexpansion of the lung and loss of pneumothoracic space in patients in whom closed pneumonolysis had been done, Brantigan and his associates [43] expressed the opinion that it resulted from an endobronchial lesion which either produced a check valve type of obstruction causing rapid reexpansion of the lung or a complete obstruction of the lung resulting in atelectasis. According to these authors, routine bronchoscopy before pneumonolysis with local treatment of endobronchial lesions stands out as the procedure of choice for this type of case. A far greater measure of success would follow if it were carried out preoperatively rather than postoperatively.

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41. Tuttle, W. M.; O'Brien, E. J.; Day, J. C., and Phillips, F. J.: Tuberculous Stenosis of the Major Bronchi, J. Thoracic Surg. **11**:299 (Feb.) 1942.

42. Durkin, H. A., and Vinson, P. P.: Tuberculous Stricture of Bronchus: Recovery Following Roentgen Therapy; Report of Case, West Virginia M. J. **38**:144 (April) 1942.

43. Brantigan, O. C.; Hoffman, R., and Proctor, D. F.: Endobronchial Tuberculosis: Its Role in Causing Rapid Reexpansion or Atelectasis of the Lung Following Closed Pneumonolysis, Am. Rev. Tuberc. **45**:477 (May) 1942.

To demonstrate the influence of bronchoscopic treatment on patients who had pneumothorax, Meyersburg and others [44] reported on the results in 3 cases in which previous collapse therapy was not effective. With bronchoscopic treatment an unsatisfactory collapse was converted into a therapeutically and anatomically satisfactory one in each patient. In all 3 cases the bronchi showed edema and congestion with obstruction of a ball valve type proximal to the cavities in question. In 1 case the mucosa appeared granular, while in the other 2 there was no evidence of endobronchial tuberculosis. In each case secretion was secured bronchoscopically. While they do not wish to arrive at any definite conclusions on the basis of these cases, they express the hope that the results secured will stimulate others to investigate the value of bronchoscopic aspiration as a therapeutic procedure in selected cases of tuberculosis in which pneumothorax has not been entirely effective.

SCLEROMA

Involvement of the upper and lower respiratory passages by scleroma is not commonly observed. Dixon [45] reported the case of a man 65 years of age who exhibited warty granulations attached to the nasal septum, thickened vocal cords and a warty growth similar to that observed in the nose attached to the lateral wall of the trachea. The tracheal walls were distorted. Microscopic studies of tissue removed from the nose and the trachea were reported as revealing rhinoscleroma. Klebsiella rhinoscleromatis was recovered from the tissue on blood agar. The patient received radiation therapy and exhibited definite improvement. Later, however, difficulty in breathing occurred, and it was necessary again to remove tissue both from the nose and from the trachea. Although definite improvement has been observed following radiation therapy, there has been a tendency for the granulomatous mass to recur slowly.

Although the literature on chronic pulmonary changes occurring in electric arc welders remains sparse, several small groups of cases have been reported in which definite roentgenographic abnormalities were discovered in the lung fields of apparently healthy workers. These changes ranged from increased hilar to generalized nodular shadows or fine mottling simulating silicosis. These appearances apparently were produced by accumulations of iron pigment and as a rule the workers were free of symptoms. Nayer [46] reported a case.

> The patient had worked steadily as an electric arc welder for seven years. During the previous year dyspnea on effort developed, which was progressive, and cough with sputum. The roentgenograms showed linear and nodular densities traversing the middle third of the right lung. The appearances suggested bronchogenic carcinoma. Bronchoscopy revealed a considerable quantity of purulent secretion in the lower end of the trachea. The orifice of the left main bronchus was narrowed, and there was an ulcerated granulating lesion on the anterior wall of the right main bronchus. Removed tissue exhibited nonspecific inflammatory changes and large masses of iron pigment scattered about. In order to relieve the stenosis it was necessary to carry out five bronchoscopic treatments. The patient's cough and dyspnea were greatly relieved, and his condition improved, although the roentgenograms exhibited no material change.

This case is unusual since the patient suffered from cough with sputum and dyspnea which apparently were produced by the bronchial involvement with resultant infection distal to this. The symptoms cleared up in great part when the bronchial obstruction was relieved by bronchoscopy. The observations are of

44. Meyersburg, H.; Gruber, H., and Lupo, C. W.: Bronchoscopic Suction: An Aid in the Closure of Cavities in Pneumothorax Cases, Am. Rev. Tuberc. **45**:368 (April) 1942.

45. Dixon, F. W.: Scleroma, Arch. Otolaryng. **36**:937 (Dec.) 1942.

46. Nayer, H. R.: Chronic Pulmonary Changes and Bronchial Ulceration in an Electric Arc Welder, J. A. M. A. **119**:1500 (Aug. 29) 1942.

interest since they represent an occupational disease and also because of the demonstration of the influence of arc welding on bronchopulmonary disease; such welding is being used extensively in the present industrial expansion.

PURPURA HAEMORRHAGICA

Symptoms of bronchial involvement in purpura haemorrhagica are uncommon. While cutaneous manifestations are commonly observed in this condition, severe hemoptysis is rare. Looper [47] reported a case.

A man aged 31 years gave a history of coughing up about a cupful of bright red blood following strenuous exercise. Extensive studies, including bronchoscopy and instillation of iodized oil, revealed no evidence of bronchopulmonary disease, although the roentgen studies showed considerable increase in the size and the density of the hilar region with exaggeration of the bronchovascular markings. At bronchoscopy a large quantity of blood-stained mucoid exudate with clots of blood was found in each main bronchus, but no source of bleeding could be demonstrated. The patient had no further difficulty until several months later, when he again had a severe attack of bleeding and shortly thereafter died. Postmortem studies did not reveal any evidence of malignant disease of the lungs or of tuberculosis; both conditions had been suspected. They did show, however, purpura hemorrhagica.

Looper emphasized the importance of considering purpura haemorrhagica in all obscure cases of severe pulmonary hemorrhage.

BRONCHIAL, PULMONARY AND TRACHEAL TUMORS

Bronchial Lipoma.—The more general employment of bronchoscopy in the diagnosis of chronic pulmonary disease has revealed an increasing number of benign tumors of the trachea and bronchi, but in spite of this tumors still are infrequently encountered in these structures. Vinson and Pembleton [48] reported a lipoma occurring in the left main bronchus and producing complete obstruction and atelectasis of the left lung. The patient, a woman aged 29 years, had been suffering for five years with cough, expectoration of foul purulent sputum and intermittent fever. Physical signs suggested the presence of extensive suppuration, and this was corroborated by roentgen study and bronchoscopic examination. Because of the extensive changes in the lung distal to the tumor it was recommended that pneumonectomy be done rather than an attempt made to remove the tumor through the bronchoscope. The patient rejected this suggestion, and coagulation of the tumor was performed bronchoscopically. Considerable improvement resulted, but it was not possible to observe the patient further because of her failure to return.

Bronchial Adenoma.—Bronchial adenoma, an epithelial tumor which probably is benign and nonmetastasizing, exhibits nevertheless certain malignant characteristics; viz., it recurs if incompletely removed. By reason of its common occurrence of an extrabronchial as well as an endobronchial tumor it often produces bronchial obstruction with chronic pulmonary suppuration, bronchiectasis and pulmonary fibrosis which, if untreated, tend to a fatal termination. In a series of 35 cases of bronchial adenoma Clerf and Bucher [49] emphasized the importance of partial or complete bronchial obstruction as an early clinical, roentgenologic and bronchoscopic finding. Later, changes in the lung distal to the tumor

47. Looper, E. A.: Bronchial Involvement in Purpura Hemorrhagica, Ann. Otol., Rhin. & Laryng. **51**:1107 (Dec.) 1942.

48. Vinson, P. P., and Pembleton, W. E.: Lipoma of Left Main Bronchus: Report of a Case and Review of Literature, Arch. Otolaryng. **35**:868 (June) 1942.

49. Clerf, L. H., and Bucher, C. J.: Adenoma (Mixed Tumor) of Bronchus: A Study of Thirty-Five Cases, Ann. Otol., Rhin. & Laryng. **51**:836 (Sept.) 1942.

complicate the diagnostic problems. For ascertaining extrabronchial extension of the tumor, tomographic studies afford valuable aid.

The diagnosis is not always easy, particularly if based on histologic examination of inadequate material alone. Many of the earlier cases were diagnosed as instances of adenocarcinoma. The bronchoscopic findings are important and should be considered diagnostically in conjunction with the biopsy results.

There has been some question regarding the treatment in these cases. In the earlier cases it was believed that endobronchial measures, notably electrocoagulation, would be adequate since the endobronchial portion of the lesion could be destroyed by this method. This would have been adequate if the growth had always been entirely within the bronchus. The common coexistence, however, of an extrabronchial portion of the tumor indicated that surgical extirpation was necessary. In addition, surgical treatment was indicated in cases in which the tumor was not accessible to bronchoscopic treatment and in cases in which there were chronic pulmonary changes distal to the tumor.

The authors reported four deaths which were directly related to the tumors. Two of these deaths resulted from associated bronchiectasis, one from pneumonia which probably was dependent on the bronchial obstruction and one from carcinoma which developed at the site of an adenoma of five years' duration. There were four deaths due to unrelated causes. One of the patients has been free from tumor for eleven years. Seven patients are well and free from symptoms although there still is evidence that the tumor is present. Four patients have tumors with symptoms; 3 of these have definite bronchiectasis and a fourth has paroxysms of coughing with occasional infection distal to the tumor, which is extrabronchial, producing compression stenosis. This patient undoubtedly has bronchiectasis distal to the stenosis. Two patients have bronchiectasis without symptoms and without tumor. They have been tumor-free for seven and ten years, respectively. Seven patients are tumor-free after periods varying from five to eleven years and also are free of symptoms. One patient has adenoma in both main bronchi and presents a hopeless problem. Surgical treatment has been recommended in 6 cases because of inaccessibility of the tumor to bronchoscopic treatment, the presence of extrabronchial adenoma or the occurrence of chronic pulmonary complications which cannot be relieved because of bronchial obstruction. Three have been treated surgically by lobectomy and 2 by pneumonectomy. There was one operative fatality. This patient had empyema and was a poor surgical risk.

Malignant Adenoma of the Lung.—The marked variability in clinical course of tumors of the lung in general has contributed greatly to the confusion of their classification as well as of their management. Adams and his associates [50] reported in detail 5 cases of adenoma of the lung. This type of pulmonary tumor is characterized by a long clinical course with definite low grade malignant manifestations. They do not believe that differentiation of benign from epithelial bronchial tumors is possible from bronchoscopic biopsy material since this offers no criteria as to the amount of tumor invading surrounding structures or the presence of a distal metastasis. This was strikingly demonstrated in a critical examination of the course and of the microscopic material in the 5 cases reported. They expressed the opinion that treatment should be based on the assumption that the tumor either is malignant or potentially malignant. It should be removed by surgical extirpation. Lobectomy should receive preference when it is sufficient

50. Adams, W. E.; Steiner, P. E., and Bloch, R. G.: Malignant Adenoma of Lung: Carcinoma-Like Tumors with Long Clinical Course, Surgery **11**:503 (April) 1942.

for the removal of the tumor-bearing tissue. The authors pointed out that this type of tumor should not be confused with the highly malignant varieties.

Cancer of the Trachea.—Cancer of the trachea is not common. The case reported by Watson [51] is unusual in that tracheal cancer occurred fifteen years after successful treatment of the patient for laryngeal cancer. Following laryngofissure and insertion of radon seeds into a growth of the left vocal cord fifteen years previously, the patient made a satisfactory recovery but continued to wear a tracheotomy tube. When observed fifteen years later he had a granular nodular patch on the posterior wall of the trachea corresponding to the site where the tip of the tracheotomic cannula came into contact with the tracheal wall. Biopsy proved this to be a cancer. The posterior edge of the tracheotomy tube had been worn paper thin by repeated cleansings, and it rubbed on the posterior wall of the trachea over the same surface as that occupied by the growth. It is reasonable to suspect that the tube produced irritation and probably also the cancer.

It was necessary to devise a special type of operation in order to remove the growth at this low level.

Bronchial Carcinoma.—Because of the importance of early diagnosis of unexplained pulmonary symptoms, particularly if carcinoma is suspected, Betts [52] emphasized the importance of prompt recourse to bronchoscopy. In a series of 62 verified cases of pulmonary tumor the diagnosis was established by bronchoscopic biopsy in 74 per cent. While roentgenologic diagnosis is important, it often is not sufficient since the extent or operability of the lesion cannot be determined by roentgenology alone. Bronchoscopy unquestionably is the most accurate method of diagnosis since small submucosal bronchial neoplasms may not produce pulmonary signs or symptoms yet can be visualized bronchoscopically. In addition, the endobronchial extent of the lesion together with the fixation and rigidity of the bronchial wall can be accurately determined.

In those cases in which the cancer cannot be treated surgically bronchoscopic dilation or removal of a portion of the tumor mass may provide better drainage and give relief from the septic symptoms. In certain cases radium or radon may be used intrabronchially, introduced through the bronchoscope.

While the present outlook indicates that thoracic surgery offers the best chance for a cure of carcinoma of the bronchus, the clinician must endeavor to make a diagnosis of cancer sufficiently early to permit therapeutic intervention. In an analysis of 56 cases White and his associates [53] agreed that bronchoscopy with biopsy is probably the most important single diagnostic procedure. Of the total of 56 cases, bronchoscopy was performed in 24, and of these cases gross abnormal changes were noted and a positive biopsy section was secured in 19. From a bronchoscopic standpoint it is important to remember that negative findings do not rule out intrabronchial disease, for the lesion may be beyond the vision of the bronchoscopist.

In a study of the duration of the illness it was found that on the average six and six-tenths months elapsed from the occurrence of symptoms to hospitalization and three and one-tenth months from hospitalization to death. From this it is apparent that the disease had consumed about two thirds of its span before

51. Watson, W. L.: Cancer of Trachea: Fifteen Years After Treatment for Cancer of Larynx, J. Thoracic Surg. **12**:142 (Dec.) 1942.

52. Betts, R. H.: Carcinoma of the Lung: Bronchoscopic Aspects, New England J. Med. **225**:519 (Oct. 1) 1942.

53. White, T. J.; Cohen, S.; Gnassi, A. M., and Price, P.: Primary Carcinoma of the Bronchus, J. A. M. A. **118**:862 (March 14) 1942.

hospitalization occurred. Such figures indicate the urgent need for an intensive educational campaign for the early diagnosis of primary carcinoma of a bronchus.

There is considerable discussion regarding the question of an actual increase in the incidence of cancer. In presenting a series of 115 cases of primary carcinoma of the lung Perrone and Levinson [54] expressed the opinion that there have been a relative and an absolute increase in the incidence of pulmonary cancer. In their series primary carcinoma of the lung accounted for 13 per cent of the total number of cases of pulmonary carcinoma.

Thirty-eight of their cases were observed and diagnosed at autopsy, and 77 were diagnosed by means of bronchoscopic biopsy. They were agreed that bronchoscopic examination is by far the most important diagnostic procedure available and should be carried out in all cases in which there is persistent cough whether productive or dry. Cough, dyspnea, hemoptysis and pain are the four cardinal symptoms of pulmonary carcinoma. Of 77 patients whose cancers were diagnosed by bronchoscopic examination only 3 had cancers amenable to surgical treatment. Of these 77 patients, 76 died within three to eighteen months from the time the diagnosis was made.

Three cases of total pneumonectomy for pulmonary lesions that from an etiologic and a morphologic standpoint were entirely different are reported by Mendez and others.[55] The first case was that of a woman aged 60 years in whom bronchoscopic examination revealed stenosis with irregularity of the mucosa of the left main bronchus. A preoperative diagnosis of a primary neoplasm of an infiltrating type involving the left main bronchus was confirmed by biopsy. At pneumonectomy there was found an infiltrating neoplasm of the left bronchus with extension to the superior mediastinum. Two months after operation dysphagia developed, and death occurred ten months after operation. At autopsy marked enlargement of the mediastinal lymph nodes was found.

The second case proved to be one of putrid abscess with multiple bronchiectatic dilations of the lower lobe of the right lung. Pneumonectomy was followed by death twenty-three days later. In the third case, apparently one of tumor of the right bronchus, the finding proved to be a tuberculous lesion. Pneumonectomy was successfully performed, and the patient was well eight months after operation.

In reporting 3 cases of bronchial carcinoma Prickman and others [56] reemphasized the importance of making a careful and complete examination of any patient who complains of symptoms suggesting asthma and the need for bronchoscopy if a correct diagnosis is to be made. Recurring hemoptysis, chills and fever or fever alone should always suggest the possibility of neoplasm, bronchostenosis or other complicating process and the need for bronchoscopic investigation.

Hemoptysis occurring in a person of an age to have cancer should suggest bronchogenic carcinoma. Tumors metastatic to the lungs from various parts of the body produce pulmonary symptoms infrequently. Rarely one invades a bronchus and simulates bronchogenic carcinoma by producing hemoptysis and cough. Freedlander and Greenfield [57] reported 2 cases of metastatic growth invading

54. Perrone, J. A., and Levinson, J. P.: Primary Carcinoma of the Lung: Report of One Hundred and Fifteen Cases, Thirty-Eight Autopsies and Seventy-Seven Bronchoscopic Biopsies, Ann. Int. Med. **17**:12 (July) 1942.

55. Mendez, J. G.; Celis, A., and Batres, L. P.: Three Cases of Pneumonectomy, Rev. mex. de tuberc. **4**:439 (July-Aug.) 1942.

56. Prickman, L. E.; Maytum, C. K., and Moersch, H. J.: Asthma and Primary Carcinoma of the Bronchus, J. Allergy **13**:261 (March) 1942.

57. Freedlander, S. O., and Greenfield, J.: Hemoptysis in Metastatic Tumors of the Lung Simulating Bronchogenic Carcinoma: A Report of Two Cases, J. Thoracic Surg. **12**:109 (Dec.) 1942.

the bronchi which presented hemoptysis as the outstanding symptom. In both cases diagnostic bronchoscopy was performed and tissue secured for histologic examination. The biopsy report was carcinoma. The final diagnosis proved to be primary malignant ovarian tumor in one case and cancer of the thyroid gland in the other.

Little difficulty is encountered in distinguishing primary from secondary or metastatic malignant neoplasms of the lung. As a rule the roentgenographic appearances of metastatic neoplasms are quite characteristic, and these rarely intrude into bronchial lumens. Nofsinger and Vinson [58] reported the case of a man aged 69 who had symptoms, physical signs and roentgen findings of a lesion in the lower lobe of the right lung. Bronchoscopic examination revealed an ulcerating pedunculated tumor in the bronchus of that lobe. Biopsy revealed the characteristic appearances of adenocarcinoma of the kidney.

After the true nature of the tumor was determined, examination of the renal areas revealed a mass in the region of the right kidney.

Bronchial Sarcoma.—A brief résumé of the case of spindle cell sarcoma of a bronchus previously reported by Baum and others [59] and a supplementary report of the observations at autopsy are given. The growth was found to involve the right bronchus. The diagnosis was made on the basis of bronchoscopic biopsy, and irradiation of the growth was carried out. A remarkable improvement followed, but the patient ultimately died, and autopsy disclosed rapidly progressing pulmonary tuberculosis complicated terminally by pulmonary gangrene due to thrombosis of the pulmonary artery.

Myerson [60] reported an unusual finding, namely, intense passive congestion of the bronchial mucosa because of a lesion in the pleural cavity. He considered such a finding as diagnostic and cited 3 cases. The mucosa appeared as a "jelly-like tumefaction" which completely obstructed the openings of the bronchi. One patient had bilateral congestion involving the bronchi to the lower lobes of both lungs. These findings were explained on the basis that there is an increased blood supply in lungs which have a thickened pleura.

By means of a special endoscopic camera Holinger [61] was able to record the gross movements of the bronchi in colored motion pictures. This method of endoscopic study will unquestionably aid in the further study of tracheobronchial movements in normal air passages as well as in those altered by disease.

DISEASES OF THE ESOPHAGUS

Cricopharyngeal Spasm.—The term "cricopharyngeal spasm" is used synonomously with "functional dysphagia," "spasmodic stenosis," "globus hystericus," "hysterical dysphagia" and "esophageal neurosis." In discussing this condition Clerf and Putney [62] emphasized that with present diagnostic aids it still is difficult to demonstrate dysfunction of the cricopharyngeus muscle.

In the presence of disease of the cervical portion of the esophagus—for example, carcinoma or a foreign body—or of chronic hypopharyngitis it is reasonable

58. Nofsinger, C. D., and Vinson, P. P.: Intrabronchial Metastasis of Hypernephroma Simulating Primary Bronchial Carcinoma, J. A. M. A. **119**:994 (July 18) 1942.

59. Baum, O. S.; Silverman, G.; Rosh, R., and Riley, R. L.: A Case of Spindle Cell Sarcoma of the Bronchus: Supplementary Report, Ann. Int. Med. **17**:750 (Oct.) 1942.

60. Myerson, M. C.: A Bronchoscopic Diagnostic Sign for Lesions of the Pleural Cavity, Ann. Otol., Rhin. & Laryng. **51**:1122 (Dec.) 1942.

61. Holinger, P. H.: Kodachrome Visualization of the Physiology and Pathology of the Tracheobronchial Tree, Ann. Otol., Rhin. & Laryng. **51**:851 (Sept.) 1942.

62. Clerf, L. H., and Putney, F. J.: Cricopharyngeal Spasm, Laryngoscope **52**:944 (Dec.) 1942.

to assume that incoordination of the swallowing function occurs; however, it is not always possible to differentiate between this and the changes produced by the disease itself. Further, it cannot be ascertained whether reflex stimuli are producing increased involuntary tonic contractions (spasm) of the cricopharyngeus or whether there is lacking the necessary stimulus to relax the normally contracted sphincter. In addition, the circular muscle fibers of the upper part of the esophagus, which are striated and receive practically the same innervation as the cricopharyngeus muscle, have a related function and probably participate in the mechanism of incoordination of the upper esophageal constrictor. One therefore should consider in the differential diagnosis carcinoma, a foreign body, pulsion diverticulum, congenital or acquired stenosis, chronic hypopharyngitis, chronic esophagitis, cardiospasm, disturbances of the thyroid gland and a host of other conditions about the neck and the upper mediastinum. Certain laryngeal disturbances also may give rise to indefinite symptoms referable to the swallowing act.

Peptic Ulcer.—Although peptic ulcer of the esophagus probably is not uncommon, it is considered to be rare in young persons. Kaplan and Zwaifler [63] reported a peptic ulcer in a patient aged 9, whose chief complaints were dysphagia for solid foods, regurgitation and at times vomiting. Esophagoscopic examination revealed a small circumscribed ulcer wth slight scarring at the crater edges. Esophagoscopic biopsy revealed gastric mucosa with slight erosions. The patient made a satisfactory recovery under medical treatment.

Syphilis.—In 2 cases of syphilis of the esophagus reported by Peterson [64] there was marked fibrosis of at least a third of the esophagus. Unlike syphilis of the stomach, that of the esophagus is followed by fibrosis to such a degree that complete regression cannot take place and dilation of the esophagus must be resorted to.

Cicatricial Stenosis.—While cicatricial stenosis of the esophagus resulting from accidental ingestion of lye is frequently encountered, complete stenosis seldom occurs. In a study of 46 patients with cicatricial stenosis of the esophagus Woodward [65] reported that in but 2 were there impermeable strictures. One of these resulted from accidental ingestion of lye, and one was due to an attempt to commit suicide by swallowing a large quantity of a lye solution. With regard to cases in which it is not possible to reduce atresia by peroral and retrograde esophagoscopic methods, Woodward recommended external exposure of the esophagus as a safe surgical procedure to be employed when other methods have failed.

In presenting a series of 13 cases of cicatricial stenosis of the esophagus resulting from accidental swallowing of caustics Grez [66] emphasized the importance of performing gastrostomy early, that is, on the fourth or the fifth day after the patient has swallowed a caustic and cannot secure an adequate amount of food or fluids. This has the advantage of placing the esophagus at rest and also allows the patient to receive an adequate amount of food. While treatment of the stricture should not be undertaken before the third week, fluoroscopy and esophagoscopy should determine the time when it should be instituted. Esophagoscopy should

63. Kaplan, S. B., and Zwaifler, N.: Peptic Ulcer of the Esophagus, Rev. Gastroenterol. **9**:108 (March-April) 1942.

64. Peterson, V. L.: Syphilis of the Esophagus, South. M. J. **35**:571 (June) 1942.

65. Woodward, F. D.: Complete Cicatricial Stenosis of the Esophagus: Permeation Made Possible by External Operation in Certain Cases, Ann. Otol., Rhin. & Laryng. **51**:94 (March) 1942.

66. Grez, A.: Stenosis of the Esophagus Due to Caustics, Rev. otorrinolaring. **11**:94 (Dec.) 1942.

be delayed until after the third week following the accident because of the liability of producing hemorrhage or other injury to an esophagus already weakened by the caustic solution.

The author had used peroral and retrograde methods of dilation and considerable emphasis was placed on the details of the treatment, particularly that of allowing the bougie to remain in situ for a long time.

A case of cicatricial stenosis of the lower third of the esophagus which developed eight weeks after posterior gastroenterostomy had been performed was reported by Larson and others.[67] The original lesion was a chronic stenosing duodenal ulcer. Probable etiologic factors were discussed, including esophagitis with ulceration due to regurgitation of gastric contents, infection spreading through lymph channels, deficient blood supply and the postoperative use of a Levine tube for three days. No definite conclusions were arrived at.

In a series of 52 strictures encountered in 46 patients, Drash and Woodward[68] found only 2 which were impenetrable. In both it was possible through exposure of the esophagus to establish a new lumen. The detailed technic of the procedure is discussed in the original paper.

The customary method of treatment of lye burns of the esophagus in a majority of institutions was to wait until the strictures developed and then to carry out some plan of dilation. Gellis and Holt[69] directed attention to the method advocated by Salzer and reported their results in a series of cases. Of 41 patients treated according to the Salzer method, only 1 subsequently had a stricture, and all of these patients have been followed at least a year. Of 14 who received no dilation, 6 later had strictures. The method consists in dilation with bougies in the form of soft rubber catheters tapered and closed at the lower end, filled with lead shot and corked above. Beginning with a small size, the operator uses bougies of increasing sizes until no. 28 or 30 is reached or until difficulty is experienced in getting a bougie down. Dilation usually is begun at once unless there is great swelling of the fauces and is carried out daily for two weeks, then three times weekly for two weeks, twice a week for two months, once a month for six months and then two or three times a year for several years. The results secured certainly indicate that this method is worthy of further investigation since dilation by other methods entails a prolonged plan of treatment and is not entirely without hazard.

Esophageal Varix.—Successful injection of esophageal varices was described by Samson and Foree.[70] From the patient's clinical history it seemed obvious that the chances for long survival without treatment were practically nil, and his age and general physical condition contraindicated surgical treatment. Esophagoscopy was performed nine times, and one or more veins were injected on each occasion. At the seventh examination no varix could be found having a lumen sufficient for injection. At the eighth and ninth examinations six varices were injected. The quantity of a 2.5 per cent solution of sodium morrhuate injected into each vein varied from 0.5 to 6.0 cc. A final note was inserted by the authors indicating

67. Larson, E. M.; Layne, J. A., and Howard, J. L.: Benign Stricture of Esophagus, Complication of Duodenal Ulcer, Journal-Lancet **62**:304 (Aug.) 1942.

68. Drash, E. C., and Woodward, F. D.: Treatment of Impenetrable Esophageal Strictures by Combined Intraesophageal and Extraesophageal Approach, Surgery **11**:886 (June) 1942.

69. Gellis, S. S., and Holt, L. E., Jr.: The Treatment of Lye Ingestion by the Salzer Method, Ann. Otol., Rhin. & Laryng. **51**:1076 (Dec.) 1942.

70. Samson, P. C., and Foree, L.: Direct Injection of Esophageal Varices Through the Esophagus, West. J. Surg. **50**:73 (Feb.) 1942.

that eight days after the report was accepted for publication the patient had a small hemorrhage followed by additional bleeding and died several days later. At postmortem examination varices were demonstrated in the lower third of the esophagus. All were thick walled and scarred. Varices were present throughout the greater portion of the stomach. Two bleeding points were found near the hiatus. In spite of the unfortunate outcome, the writers expressed the opinion that the injection method should not be discouraged. Esophagoscopy should be performed at intervals of six months or even less following the completion of treatment to ascertain if there are present newly developed varices so that adequate treatment may be instituted before hemorrhage supervenes.

Tuberculosis of the Esophagus.—Guggenheim and others [71] reported the case of a man who presented symptoms of dysphagia and choking sensations. These became progressively worse until he had difficulty swallowing fluids. A roentgen study of the swallowing function showed dilatation of the esophagus with a distinct narrowing in the region of the cardia. Esophagoscopy revealed a fungating mass, but no specific diagnosis could be made on the basis of biopsy. It was not until autopsy was performed that fibrocaseous nodules in the muscular layer of the lower third of the esophagus were discovered. These proved to be tuberculous.

Although tuberculosis of the esophagus may originate in a variety of pathways, its occurrence is not common. Carr and Spain [72] reported the unusual finding of squamous cell carcinoma of the esophagus associated with tuberculosis. The association was noted at postmortem examination. A failure to find hematogenous tuberculosis elsewhere and the absence of tuberculous lymphadenitis and periesophageal adhesions suggested that the tuberculosis was secondarily implanted on the carcinoma as a result of swallowing exudate loaded with tubercle bacilli.

Polyps of the Esophagus.—Hemorrhage due to polyps of the esophagus is rare. Dickes and others [73] reported the case of a girl aged 10 who had repeated gastrointestinal hemorrhages over a period of five years. A diagnosis of Banti's disease was considered, and the bleeding was believed to be from varices of the esophagus. There was temporary improvement following splenectomy.

With recurrence of hemorrhage, esophagoscopy was performed. Numerous polyp-like masses of various sizes and shapes were found studding the esophageal mucosa. Esophagoscopy was done a second time, and biopsy was performed. The findings suggested multiple polyp, and repeated fulguration was carried out esophagoscopically, with recovery of the patient.

In a report based on a study of 26 cases of grossly pedunculated tumor of the esophagus, which included a case reported by Samson and Zelman,[74] it was found that the tumor occurred predominately in men after the fifth decade of life. Malignant degeneration was uncommon. While this type of tumor is rare, it is of importance in that 3 of the 26 patients died suddenly because of regurgitation of the tumor into the larynx. The writers expressed the opinion that endoscopic removal is superior to extirpation by external esophagotomy.

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71. Guggenheim, A.; Rotenberg, L., and Laff, H. I.: Tuberculosis of the Esophagus, Am. Rev. Tuberc. **46**:577 (Nov.) 1942.

72. Carr, D. T., and Spain, D. M.: Tuberculosis in a Carcinoma of the Esophagus, Am. Rev. Tuberc. **46**:346 (Sept.) 1942.

73. Dickes, R.; Knudsen, A. F., and Franco, S. C.: Multiple Polyps of Esophagus: Report of Case with Complicating Recurrent Gastrointestinal Hemorrhages, Arch. Int. Med. **70**:121 (July) 1942.

74. Samson, P. C., and Zelman, J.: Pedunculated Tumors of the Esophagus, Arch. Otolaryng. **36**:203 (Aug.) 1942.

Fibrolipoma of the Esophagus.—An interesting and unusual pedunculated tumor of the hypopharynx was reported by Davison.[75] It occurred in a man aged 70. He exhibited no inconvenience or distress from the tumor which was attached to the lateral wall of the hypopharynx and when regurgitated projected from the mouth for about 4 inches (10 cm.). The pedicle was transfixed with a needle carrier ligature and then severed by diathermy. The tumor measured 8 inches (20 cm.) in length and proved to be fibrolipoma.

Leiomyosarcoma of the esophagus occurring in a man aged 53 was reported by Pennes.[76] There was slight dysphagia for solid foods which lasted for five days and then disappeared. Roentgen study revealed a spherical mass which displaced the lower portion of the trachea and an extensive filling defect in the middle third and the upper part of the lower third of the esophagus. The moth-eaten appearance of the stenotic area suggested a malignant tumor. At esophagoscopy a cauliflower-like mass was seen extending from the posterior esophageal wall, producing almost complete obstruction. The biopsy report was leiomyosarcoma. Gastroscopy and irradiation of the growth were carried out with slight improvement.

Carcinoma of the Esophagus.—Carcinoma of the esophagus is seventh in frequency of types of carcinoma among males. In a study of this condition Holinger and Hara [77] reported on a series of 100 consecutive cases. Predisposing factors, signs and symptoms, diagnostic measures and complications were discussed. Roentgen study and esophagoscopy are the two most important factors in establishing the diagnosis. Dysphagia always is intermittent in the beginning but usually persists as a late symptom. It is indicative of obstruction due either to an endoesophageal growth or to an infiltration of the wall of the esophagus interfering with normal function. Absence of demonstrable physical signs is a characteristic feature of the disease, and as a result an erroneous diagnosis of globus hystericus, of cardiospasm or of gastric ulcer is often made in the early stages. Usually no correlation is found between the patient's complaints and the extent of the lesion.

Because of the insidious onset and relatively smooth course of the lesion in its incipiency no patient can definitely establish its beginning. The cancer remains localized until very late, and metastasis to distant organs usually occurs in less than half of the cases. Surgical treatment offers the best opportunity for cure if the growth is limited to the lumen of the esophagus.

Hudson [78] reported successful surgical removal of carcinoma of the proximal portion of the upper third of the esophagus in 2 cases. Since lesions involving the upper end of the proximal third of the esophagus are so intimately associated with or involve the larynx, it is necessary that both the esophagus and the larynx be removed if a cure is to be expected. Although metastatic involvement of the regional lymph nodes occurs late, it is imperative that the diagnosis be made early. He made a plea that every patient who complains of any sort of distress on swallowing be studied carefully not only by roentgen examination but also by endoscopic means.

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75. Davison, F. W.: Fibrolipoma of the Laryngopharynx, Ann. Otol., Rhin. & Laryng. **51**:853 (Sept.) 1942.

76. Pennes, A. E.: Leiomyosarcoma of the Esophagus, Am. J. Roentgenol. **48**:336 (Sept.) 1942.

77. Holinger, P. H., and Hara, H. J.: Cancer of the Esophagus: Study of One Hundred Consecutive Cases, Laryngoscope **52**:968 (Dec.) 1942.

78. Hudson, W. A.: Carcinoma of the Esophagus: Some Observations with Two Case Reports, Ann. Otol., Rhin. & Laryng. **51**:1125 (Dec.) 1942.

Hernia of the Diaphragm.—The diagnosis of diaphragmatic hernia is almost entirely dependent on roentgenographic studies. In a discussion of this subject Young [79] described the two methods of outlining the hernia, namely, from below by filling the stomach with barium sulfate and placing the patient in the horizontal or Trendelenburg position, and from above by coating the esophagus with barium sulfate and following its downward course. Failure to make a diagnosis of herniation by these methods even though a hernia exists is possible, and the causes are enumerated. He also referred to the value of endoscopic examination of the esophagus and herniated stomach, especially when there is doubt as to the diagnosis of herniation. Erosions at the site of constriction and chronic mucosal inflammatory changes have thus been noted.

FOREIGN BODIES IN AIR AND FOOD PASSAGES

While it is not customary to accept any statement from a patient which cannot be confirmed by further examination of his history, physical signs or roentgenologic or pathologic reports, Morlock and Edelston [80] suggested that there are times when he is right. While aspiration of a foreign body into the tracheobronchial tree is a well recognized accident, the patient's statement often is not readily confirmed and is not accepted. The case records of 4 overlooked foreign bodies, each with a history of a foreign body accident available, are cited.

The importance of considering a foreign body as a possible etiologic factor in the study of any patient, particularly a child, who exhibits symptoms of acute laryngotracheobronchitis was emphasized by the case report of Gilmore and Grant.[81] A child was treated for a cold and later marked laryngeal dyspnea developed. The case was then considered as one of acute laryngotracheobronchitis. Tracheotomy was performed with complete relief from dyspnea, and the treatment recommended for acute laryngotracheobronchitis was instituted. About three hours later the patient died suddenly in spite of the fact that the tracheal cannula was patent and suction applied to the trachea was nonproductive. At autopsy a sunflower seed was found obliquely situated in the lower end of the trachea at the level of the carina; it was impacted in the left main bronchus and obstructed the right bronchus. This case illustrated the difficulty of making a diagnosis of obstruction caused by a vegetal foreign body and emphasized the extreme importance of the history and also of a bronchoscopic examination either prior to or immediately after tracheotomy in all such cases.

In discussing a case in which he found a common pin as a foreign body in a terminal bronchiole, Carruthers [82] emphasized the need for an adequate instrumentarium, which should include proper bronchoscopes and forceps, and the need for biplane fluoroscopic guidance since the foreign body could not be visualized at any time through the bronchoscope. He found that local anesthesia supported with adequate preoperative sedation was the most satisfactory form, but it was necessary to instil the anesthetic solution down into the terminal bronchi.

Although lodgment of a foreign body in an upper lobe bronchus is rare, it constitutes a major problem in bronchoscopy. Employment of curved upper lobe forceps used under biplane fluoroscopic guidance can solve the problem in

79. Young, D.: Esophageal-Hiatus Hernia, Rev. Gastroenterol. **9**:345 (Sept.-Oct.) 1942.

80. Morlock, H. V., and Edelston, B. G.: Foreign Bodies in Air Passages, Lancet **1**:138 (Jan. 31) 1942.

81. Gilmore, G. B., and Grant, M. D.: Suffocation by a Sunflower Seed, Laryngoscope **52**:993 (Dec.) 1942.

82. Carruthers, D. G.: The Problem of a Common Pin as a Foreign Body in a Terminal Bronchiole, Ann. Otol., Rhin. & Laryng. **51**:257 (March) 1942.

most cases. In a case reported by Moorhead [83] a lather's nail was lodged in the upper lobe bronchus of the right lung. While the point of the nail could be seen and grasped, it was not possible to withdraw it because the long axis of the forceps did not coincide with that of the nail and as a result the point of the nail impinged on the bronchial wall in any attempt at manipulation. Moorhead performed therapeutic pneumothorax which allowed the upper lobe to collapse, and this brought the nail into the axis of the main bronchus. With the aid of a single plane fluoroscope the problem was greatly simplified, and the nail was easily withdrawn into the lumen of the bronchoscope and removed. There was no reaction from the bronchoscopic procedure or from the pneumothorax, and the patient made a prompt recovery.

Two unusual cases of foreign body are reported by Freedman.[84]

In the first instance a child aged 7 years was discovered to have a ring in the esophagus in the examination of a routine roentgenogram of the thymus gland made preliminary to tonsillectomy. On close questioning the parents stated that a small ring which had been presented to the child when it was 6 months old had disappeared. At esophagoscopy the ring was readily visualized in the upper thoracic region of the esophagus. It could not be removed by traction because of the presence of fibrous tissue bands which were tightly adherent to the foreign body. The ring was cut with a caliper rotation forceps in two places, one in front of and one behind the portion containing the stones, and the two parts were removed separately. The postoperative course was uneventful.

In the second case a seamstress gave a history of having inhaled a common pin. Roentgen studies revealed two pins, one in the upper portion of the pharynx, the other in the region of the upper lobe of the left lung. The pin from the pharynx was readily removed. Bronchoscopic examination failed to reveal the second pin in the trachea or the bronchus. Further studies of the roentgenogram and fluoroscopic observation of the foreign body localized it in the musculature of the back behind the scapula. It proved to be a hypodermic needle which had been broken off several years earlier when a hypodermic injection was given in that region.

In a report covering a series of 230 cases of foreign body in the air and food passages, Gill and Gressette [85] stated that foreign bodies were more often found in the food passages and that coins predominated. The peanut was the most frequent foreign body in the air passages. They observed that the diagnosis now appears to be made more promptly than when the earlier cases were reported. They have abandoned the idea that anesthesia, local or general, is not necessary in children and usually give some form of anesthetic to every patient who is not dyspneic. Muscular relaxation is secured by the use of morphine sulfate and atropine or sodium amytal supplemented with ether if necessary to abolish the cough reflex completely.

Perforation of the thoracic wall by an aspirated foreign body is uncommon. Curiously a large proportion of these objects have been leaves of evergreens. In the case reported by Bowen [86] there was a history of swallowing (?) a cedar leaf followed by cough, weakness, anorexia and later hemoptysis with chills and fever. Diagnoses of pleurisy and pneumonia were made, but the true nature of the condition was not discovered until a hard swelling appeared over the lower right side of the chest. This was incised, and a considerable quantity of pus together with a portion of the cedar leaf was evacuated.

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83. Moorhead, R. L.: Foreign Body in the Upper Lobe Bronchus, Ann. Otol., Rhin. & Laryng. **51**:1119 (Dec.) 1942.

84. Freedman, L. M.: Inhalation of a Foreign Body: Report of Two Unusual Cases, Arch. Otolaryng. **36**:944 (Dec.) 1942.

85. Gill, E. G., and Gressette, J. H.: Observations in Management of Two Hundred and Thirty Foreign Bodies in the Air and Food Passages, Virginia M. Monthly **69**:66 (Feb.) 1942.

86. Bowen, F. H.: Perforation of an Aspirated Cedar Leaf Through the Chest Wall, South. M. J. **35**:24 (Jan.) 1942.

Two patients with mediastinitis following esophageal foreign body accidents were successfully treated by McHenry [87] by cervical mediastinotomy. In neither was a foreign body found within the esophagus by esophagoscopy or in the periesophageal tissues. While there was extensive cellulitis about the esophagus, together with marked necrosis and drainage of pus for many days, the patients both ultimately made a satisfactory recovery.

Penetrating foreign bodies of the thoracic wall usually do not cause hemoptysis without evidences of injury to the pleura. In the case reported by Orton [88] a man accidentally ran a wooden splinter into the right side of his neck. Shortly thereafter dysphagia developed but cleared up, and then hemoptysis occurred. All of the studies, including the bronchoscopic, gave negative results. Subsequently blood was traced to the orifice of the upper lobe of the right lung. The development of lymphadenitis suggested the possibility of carcinoma, and thoracotomy was performed. Manipulation of the upper lobe of the right lung produced severe bleeding, and it was necessary to place a tourniquet around the lobe. In cutting down on the lobe a foreign body was met with. This proved to be the splinter that had penetrated the root of the neck, entered the upper lobe of the right lung and perforated a large vessel.

In a study of a series of 386 cases of foreign bodies in the gastrointestinal tract Van Loon and Diamond [89] concluded that a majority of these do not have to be removed endoscopically or surgically. More than 90 per cent passed spontaneously, although the time necessary for their passage seemed unaccountably prolonged. Of the 386 patients, 28 were less than 1 year of age, and 177 were between 1 and 4 years of age. The youngest was an infant 7 weeks old who swallowed an open safety pin, which passed in a stool two days later. In 17 patients the foreign body did not leave the stomach; removal was accomplished by fluoroscopically guided open tube gastroscopy in 14 and by external operation in 3. The question of pointed objects was discussed from the standpoint of gastroscopic removal and their treatment if they have already advanced beyond the pylorus. If the diagnosis of perforation is to be made early enough to insure the performance of laparotomy before additional complications arise, it must be made by roentgen examination and not based on the patient's symptoms or physical signs.

DIAGNOSIS BY GASTROSCOPY

Although it is generally admitted by those familiar with gastroscopy that it is valuable in diagnosing gastric lesions and has influenced therapeutic management of these, it must be borne in mind that the method is not infallible and that it has definite limitations. Jankelson and McClure [90] are agreed that gastroscopy is a safe procedure in the hands of experienced examiners. It gives important objective evidence of intragastric disease. However, there are limitations to its usefulness, in part due to intrinsic causes, in part due to imperfections in the present instrumentarium. Moreover, there are definite areas within the stomach that are inaccessible to the semiflexible gastroscope. Therefore the failure to visualize a lesion does not exclude the presence of one. On the other hand, the demonstration of a lesion

87. McHenry, L. C.: Two Cases of Mediastinitis Following Esophageal Foreign Bodies, Ann. Otol., Rhin. & Laryng. **51**:1083 (Dec.) 1942.

88. Orton, H. B.: Penetrating Wound of the Neck with Unusual Complications and Sequelae, Ann. Otol., Rhin. & Laryng. **51**:1050 (Dec.) 1942.

89. Van Loon, E. L., and Diamond, S.: Foreign Bodies in the Gastrointestinal Tract, Ann. Otol., Rhin. & Laryng. **51**:1076 (Dec.) 1942.

90. Jankelson, I. R., and McClure, C. W.: Limitations of Gastroscopy, Rev. Gastroenterol. **9**:257 (July-Aug.) 1942.

denotes disease. The interpretation of an observed lesion is not easy and requires wide experience. Indeed, the dependability of a gastroscopic diagnosis is directly related to the experience of the examiner. Therefore, although gastroscopy is a fairly simple procedure, only physicians with access to a large clinical material should attempt to master it. Furthermore, the final diagnosis should be made by the clinician on the basis of all available data, the gastroscopic evidence being only a single link in the chain of evidence.

In an analysis of the results of 938 gastroscopic examinations performed on 842 patients, Renshaw and others [91] expressed the opinion that gastroscopy has been of value and had made a significant contribution in 217, or 25.6 per cent, of the cases. A minor contribution was made in 566, or 55.4 per cent, while in 160, or 19 per cent, gastroscopy was considered to have been a failure. The most common cause of failure was inability to visualize the area in question; other causes were anatomic difficulties, inconclusive or wrong interpretation of the observations, poor cooperation, technical failure of the instrument and pharmaceutic reactions. They expressed the opinion that gastroscopy is a valuable adjunct to other diagnostic procedures. While it has certain limitations, they do not minimize its value if the clinician fully appreciates them.

In a study of the results of 1,500 gastroscopic examinations McClure and Jankelson [92] found that gastroscopy was useful in the study of all gastric lesions but was of particular importance as a diagnostic procedure in cases of chronic gastritis, peptic ulcer and gastric carcinoma.

Over 42 per cent of these examinations revealed evidence of chronic gastritis. In 50 per cent of this total the gastritis was found secondary to another intragastric or extragastric disease. Gastroscopy was of value in determining the extent of gastritis. In cases of gastric ulcer it permitted visualization of the depth of the ulcer, a study of the surrounding mucosa and observations on the progress of healing. It was confirmatory of the suspicion of a carcinomatous lesion aroused by the roentgen appearances and of that in cases in which there was no roentgen evidence; it also was of value in detecting small gastric polyps and gave an estimate of their size and character. In the authors' opinion gastroscopy is extremely useful as a complementary method of diagnosis and in addition gives evidence not obtained by any other method.

The frequent occurrence of anemia and hypochlorhydria or achlorhydria in both hypothyroidism and atrophic gastritis suggested to Golding [93] the desirability of studying a series of patients suffering from hypothyroidism or myxedema. Gastroscopic examinations were made in 11 cases. Atrophy of the gastric mucosa was diagnosed positively in 10 cases, and probable atrophy was observed in the eleventh case. While no definite conclusions can be arrived at from such a small series, the hypothesis that hypothyroidism and myxedema are accompanied by a high incidence of gastric atrophy seems worthy of further investigation.

In presenting 3 cases of benign submucosal tumor of the stomach Schindler and others [94] described a characteristic sign which can be observed in these cases and which in their opinion is diagnostic, as it is not compatible with a mucosal

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91. Renshaw, J. F.; Clark, G. E., Jr., and Forsythe, J. R.: Critical Analysis of Nine Hundred and Thirty-Eight Gastroscopic Examinations, Am. J. Digest. Dis. **9**:401 (Dec.) 1942.

92. McClure, C. W., and Jankelson, I. R.: Clinical Application of Gastroscopy, New England J. Med. **227**:548 (Oct. 8) 1942.

93. Golding, F. C.: The Association of Atrophic Gastritis with Hypothyroidism: A Preliminary Report of Eleven Cases, Ann. Int. Med. **17**:828 (Nov.) 1942.

94. Schindler, R.; Sandweiss, D. J., and Mintz, I. L.: Benign Submucosal Tumors of the Stomach: A Gastroscopic Study, Am. J. Digest. Dis. **9**:289 (Sept.) 1942.

tumor. It is the stretching of a mucosal fold from the surrounding mucosa up to the surface of the tumor, apparently bridging the space between the top of the tumor and the level of the surrounding mucosa.

In a study of 133 gastric lesions by Schindler and Arndal,[95] 79 were found to be benign and 34 malignant. In presenting this group of cases they wished to emphasize the importance of gastroscopy in differential diagnosis since this is the best method for differentiating noncancerous from cancerous ulceration. Most gastric ulcers are clearly seen through the gastroscope, although any that occur along the lesser curvature in the antrum may escape detection. A small but not unimportant group of gastric ulcers which escape even the most refined roentgen relief compression technic can readily be seen with the gastroscope. The condition of the mucosa surrounding an ulcer can be determined only by gastroscopic visualization, and further the healing of benign gastric ulceration is best observed gastroscopically.

The early diagnosis of gastric cancer is best accomplished by employing methods that give visual evidence of pathologic changes since the clinical picture often is misleading. Gastroscopy and roentgenologic examination are valuable for the direct postoperative study of the mucosa and deeper layers of the stomach. In determining the relation between gastroscopy and roentgenologic examination in the diagnosis of gastric cancer Templeton and Boyer[96] propounded two questions, namely, How many lesions are visualized by one method and not by the other? and How often is the differentiation between noncancerous and cancerous lesions made correctly by one and not by the other? In an attempt to answer these questions 189 selected cases in which both gastroscopic and roentgenologic examinations were made were studied. They compared the findings from both methods in a study of polypoid, ulcerating and infiltrating lesions. From the comparison they expressed the opinion that in most instances gastric cancer visible by one method is demonstrable by the other. While the lesion may be visible only to the gastroscopist or to the roentgenologist, opinions may vary regarding whether a given lesion is a cancer. Therefore, a combination of gastroscopic and roentgenologic examination will result in a higher percentage of correct diagnosis than will the use of either procedure alone.

While the roentgen ray has materially overcome many of the great difficulties in diagnosing pathologic changes in the stomach, gastroscopy has unquestionably earned a place as an important diagnostic procedure. Clerf and Wirts[97] reported on the gastroscopic and roentgenologic findings in 34 patients with gastric ulcer or cancer. These were not observed consecutively but were specially selected because in each instance the gastroscopic examination was important in arriving at an exact diagnosis. In determining whether an ulcer demonstrated by roentgen examination was noncancerous or cancerous it was found that supplementing the roentgenologic information with gastroscopic inspection aided materially in arriving at final conclusions.

Case histories are cited, and the roentgenologic and gastroscopic findings are noted, with appropriate comments concerning the importance of the diagnostic procedures and the supplementary aid that gastroscopic examination gives to the roentgenologic findings for the differentiation between ulcer and carcinoma.

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95. Schindler, R., and Arndal, O.: Gastroscopic Differential Diagnosis of Benign and Malignant Ulcer of Stomach: Analysis of Gastroscopic Picture of One Hundred and Thirty-Three Lesions, Arch. Surg. **44**:473 (March) 1942.

96. Templeton, F. E., and Boyer, R. C.: Diagnosis of Gastric Cancer: Analysis of Gastroscopic and Roentgenologic Findings, Am. J. Roentgenol. **47**:262 (Feb.) 1942.

97. Clerf, L. H., and Wirts, C. W., Jr.: The Importance of Gastroscopy in Differentiating Gastric Ulcer and Carcinoma, Rev. Gastroenterol. **9**:1 (Jan.-Feb.) 1942.

In an analysis of 95 cases of gastric tumor in all of which gastroscopy had been performed before operation, an attempt was made by Schindler and Letendre [98] to determine the significance of gastroscopy to the surgeon. In 91 cases of carcinoma the lesion was not seen gastroscopically in 5, this in spite of the fact that it was known before the gastroscopic examination that a carcinoma was present. In 5 other cases the lesions observed were wrongly interpreted.

In their opinion roentgenography and gastroscopy should yield the best results in diagnosis of gastric tumors when used together. In this series of 91 cases of carcinoma there were fifteen failures at the first roentgen examinations as compared with ten failures at the first gastroscopic examinations. The size and the site of the tumor were determined satisfactorily by gastroscopy.

In a report of a case of prolapse of gastric mucosa in which the lesion was misinterpreted gastroscopically as carcinoma, Moersch and Weir [99] emphasized the importance of repeated gastroscopic examinations, particularly when there is some question as to diagnosis. They also pointed out that palpation of the abdomen during the gastroscopic examination is undoubtedly of value in the study of gastric disease.

128 South Tenth Street.

98. Schindler, R., and Letendre, P.: Analysis of Relationship of Surgery and Gastroscopy in Ninety-Five Cases of Gastric Tumor, Surg., Gynec. & Obst. **75**:547 (Nov.) 1942.

99. Moersch, H. J., and Weir, J. F.: Redundant Gastric Mucosa Simulating Carcinoma of the Stomach, Am. J. Digest. Dis. **9**:287 (Sept.) 1942.

Abstracts from Current Literature

Ear

EARACHE: THE COMMON CAUSES AND PROBABLE NERVE PATHWAYS. E. EDWARD TREMBLE, Ann. Otol., Rhin. & Laryng. **51**:1017 (Dec.) 1942.

Sensation is supplied to the anterior walls of the external auditory canal and a small part of the anterior portion of the auricle by the auriculotemporal branch of the third division of the fifth nerve. Practically the whole surface of the auricle is supplied by the auricular branches of the great auricular and small occipital nerves from the second and third cervical segments, with an occasional twig from the great occipital nerve. Arnold's nerve, the auricular branch of the vagus, supplies the posterior and inferior walls of the external canal and the concha. There is some evidence that the seventh nerve supplies some sensation to the concha and to the posterior surface of the auricle, and the geniculate ganglion appears to have part in innervating the concha and the external canal.

The tympanic membrane is supplied in its posterior portion by Arnold's nerve and the anterior portion by the auriculotemporal nerve. The inner surface receives sensation through the tympanic nerve, a branch of the ninth.

The middle ear is supplied with sensation through a plexus on the inner wall formed by nerves derived from Jacobson's nerve from the ninth nerve, the geniculate ganglion of the facial nerve and the caroticotympanic branches from the carotid sympathetic plexus. The mastoid cells are supplied sensation through a mastoid branch of the tympanic plexus, and the skin of the mastoid is innervated by branches of the great auricular and small occipital nerves.

Earache may be due to conditions in the external canal, the middle ear or the mastoid cells. It may be due to more remote causes. Sinusitis, particularly sphenoethmoiditis, may produce otalgia through the sphenopalatine ganglion, along the superficial petrosal nerve to the geniculate ganglion, which sends branches to the tympanic plexus. Dental involvement, particularly that of the lower jaw, causes more than half of the otalgias from remote causes. The pain is steady and persistent and worse at night and is carried through branches of the fifth nerve. Dental caries is the most common cause, but occasionally an unerupted wisdom tooth may cause pain.

Lesions of the side of the tongue, particularly of the anterior two thirds, caries of the lower teeth, inflammation of the salivary glands and disease of the temporomandibular joint may all cause reflex pain through the auricular branch of the auriculotemporal nerve. A lesion on the anterior part of the tongue may cause pain in front of the ear through involvement of the nerve endings of the auriculotemporal nerve through the lingual branch of the fifth nerve. A lesion on the posterior third may cause severe pain within the ear through irritation of the ninth nerve with reflex pain through its tympanic branch to the tympanic plexus.

Ulcerative lesions of the larynx or the upper part of the trachea may cause reflex otalgia through irritation of the superior laryngeal branch of the tenth nerve.

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POSITIONAL NYSTAGMUS IN CEREBELLAR LESIONS. E. A. SPIEGEL and N. P. SCALA, J. Neurophysiol. **5**:247, 1942.

After lesion of a part of the cerebellum of the cat, particularly the lobus posterior medianus, nystagmus was observed with abnormal positions of the head, particularly when the animal was in the supine position with the vertex downward. Nystagmus that was weak with the head in a normal position was increased with abnormal positions, sometimes with a change in its direction; or nystagmus appeared with abnormal positions only. This phenomenon was transient. Electrolytic lesions of the tectal nuclei had a similar effect. In the analysis of the receptor mechanism, cervical reflexes and retinal reflexes could be excluded. Bilateral labyrinthectomy abolished the effect of position, while weak spontaneous nystagmus might persist. The authors assume that the appearance of positional nystagmus after cerebral lesions is a phenomenon of release of parts of the vestibulo-ocular reflex arcs, since it is associated with increase of the experimental postrotatory nystagmus. The experiments suggest that the occurrence of positional nystagmus should be tested routinely when a cerebellar lesion is suspected.

DRAYER, Philadelphia [ARCH. NEUROL. & PSYCHIAT.].

TREATMENT OF INFLUENZAL MENINGITIS WITH ANTI-INFLUENZAL RABBIT SERUM AND SULFAPYRIDINE. JOHN P. SCULLY and MAUD L. MENTEN, J. Pediat. **21**:198 (Aug.) 1942.

Scully and Menten report recovery in 5 of 9 cases of influenzal meningitis with use of Squibb's anti-influenzal rabbit serum and sulfapyridine. The injection of a sodium salt of hydroxyethylapocupreine intrathecally was also tried and seemed to exert some bacteriostatic effect. The importance of mastoidectomy in cases of otitic involvement is stressed.

STETTENBENZ, Buffalo [AM. J. DIS. CHILD.].

SUBACUTE CATARRHAL OTITIS MEDIA. J. MATTHEWS ROBISON, South. M. J. **35**:815 (Sept.) 1942.

Robison classifies cases of subacute catarrhal otitis media and mastoiditis on the basis of the underlying pathologic change and the type of effusion found in the middle ear and mastoid cavities. He describes two types. In type 1 the effusion is an exudate, while in type 2 it is a transudate and contains much less albumin and globulin than does that of type 1. Type 1 occurs in the presence of infection in the nasal sinuses or the nasopharynx or both; when the infection is eliminated the aural symptoms usually subside. In type 2 there is no evidence of disease in the sinuses or the nasopharynx. The effusion apparently results from idiopathic closure of the eustachian tube. There is a definite tendency for both types of the disease to recur. The treatment consists in the elimination of the infection in the sinuses and the nasopharynx in type 1, inflation of the eustachian tube, paracentesis and local and mass suction; if the more conservative measures fail and the hearing grows worse, simple mastoidectomy is indicated.

SINGLETON, Dallas, Texas.

LATERAL SINUS THROMBOSIS: RECENT DEVELOPMENTS IN TREATMENT. J. DUDLEY SINGLETON, South. M. J. **35**:756 (Aug.) 1942.

Observations on series of 6 cases of otogenic sepsis and thrombosis of the lateral sinus were summarized. The patients were 5 children and 1 adult. Four had occluding thrombi with central liquefaction of the clot; 2 of these presented septic symptoms; the other 2 showed no septic symptoms; 1 had a positive blood culture. Of the 2 remaining patients, both showed septic symptoms and had positive blood cultures; one had phlebitis but no thrombus; the remaining patient showed no involvement of the sinus but had a metastatic abscess of the hip. The internal jugular vein was ligated in 2 cases. All the patients were given small blood transfusions: One received a transfusion of convalescent blood and an intravenous injection of immune serum. Four received sulfanilamide. All of the patients recovered.

When positive blood cultures are not obtained before operation, it is important to make a special effort to secure cultures from the mastoid cells and the lateral sinus. The infecting organism should be identified. Ligation of the internal jugular vein is not indicated in all cases of thrombosis of the lateral sinus; thorough exenteration of the primary focus in the mastoid process with incision and drainage of the lateral sinus will prove adequate in most cases. The treatment should be adapted to the individual case. Such measures as frequent transfusions of whole blood, transfusions of recent convalescent blood, and injections of immunized blood, convalescent and immunized serum, and type-specific pneumonic serum are useful in the treatment of the disease. The use of the sulfonamide compounds should vary, depending on the infecting organism, and the dosage should be adequate. Heparin may prove useful in the treatment of selected patients.

SINGLETON, Dallas, Texas.

THE PHYSIOLOGY OF THE LABYRINTH REVIEWED IN RELATION TO SEASICKNESS AND OTHER FORMS OF MOTION SICKNESS. W. J. MCNALLY and E. A. STUART, War Med. **2**:683 (Sept.) 1942.

McNally and Stuart have reviewed the entire literature on the physiology of the labyrinth, and they discuss the functions of the various parts in detail. The most important points may be summarized as follows: The semicircular canals are stimulated by angular acceleration. The stimulation of a canal is unidirectional; it elicits reactions of the head and body muscles necessary to compensate for any movement of the head in the plane of the canal. Deflections of the cupula are responsible for nystagmus. The otoliths are stimulated by linear acceleration, or progressive movement. An otocyst can function without an otolith, but in animals normally possessing otoliths this organ modifies the reactions of the sensory hair cells and its absence produces disturbance of equilibrium. The saccule is not concerned with equilibrium but may be influenced by vibrational stimulation. The utricle is the most important gravity organ. It is stimulated by slow tilting about a horizontal axis, by centrifugal

force and by linear acceleration. Its stimulation elicits all postural reflexes of the body and eyes previously allocated to both the saccule and the utricle. It is the end organ for the perception of linear acceleration. Vertical progressive linear acceleration is the most disturbing factor in the production of motion sickness. Centrifugal force stimulates the utricles, while the canals and saccules are unresponsive. Chronic increased intralabyrinthine pressure can damage the labyrinth, just as increased pressure produces choked disk. Mack's estimation of the threshold of labyrinthine stimulation for both angular and linear acceleration is still the standard for human beings.

Nystagmus does not occur in cases of seasickness. The question whether seasickness occurs in deaf-mutes and the reason for its absence need a great deal more investigation. The canals and the utricular otoliths are concerned in the body's response to sudden emergencies. They act as a check on each other in maintaining the degree of muscle tone necessary for formal posture and the normal reaction to sudden stimuli. The labyrinth is represented cortically in the posterior part of the temporal lobe. The vestibular nerve runs to the vestibular nuclei. From there the connections are widespread, especially with the cerebellum. Much more work is needed before these connections are fully understood. Opinions vary as to whether the labyrinth can become habituated to stimulation. If it can be, this habituation seems to be associated with the learning process.

PEARSON, Philadelphia [ARCH. NEUROL. & PSYCHIAT.].

DESQUAMATIVE OTITIS EXTERNA IN MALTA. W. I. DAGGETT, J. Laryng. & Otol. **57**:427 (Oct.) 1942.

Otitis externa is common in hot, humid climates, and it has been the cause of considerable morbidity in the garrison at Malta. The disease may be divided into four stages: (1) acute, (2) subacute, (3) chronic and (4) relapsing.

The initial stage is manifested by pain in and around the affected ear. The pain is exaggerated by mastication or any action that produces movement of the meatus. At this time the skin lining the meatus is red and slightly swollen. The drum is easily seen, and the landmarks are all distinguishable. The hearing is normal. After a short time the swelling becomes so marked that even the smallest speculum cannot be inserted into the external canal. The canal then becomes filled with a cheesy debris as a result of desquamation of the epithelium, and a variable amount of thin straw-colored discharge appears. Now the patient has extreme pain in the affected ear, the mastoid area may be swollen, fever is present and the hearing is considerably impaired.

The subacute stage is only a protraction of the acute stage. Although the patient is not seriously ill, he is uncomfortable and irritable. Examination shows the characteristic cheesy detritus in the canal. The drum, if it can be seen, is usually red and swollen. The deep anterior meatal recess is considered the most significant portion of the canal in which the debris accumulates, and unless attention is given to this area, treatment will not be satisfactory.

In the chronic stage the chief symptoms are muffled hearing and a slight, offensive discharge. In this stage debris is found at times only in the anterior recess of the canal.

A study of the organisms found showed a mixed flora with diphtheroids, Bacillus pyocyaneus, Bacillus proteus and Staphylococcus predominating. In only a single case conforming clinically to one of diffuse external otitis was there a suspicion of a few scattered mycelial threads. The cause of external otitis is the object of much speculation. Probably high temperature, great humidity and hyperactivity of the sweat glands tend to produce maceration of the skin which permits the infection to gain a footing. Since of 164 patients, 76 were nonswimmers, swimming per se cannot be regarded as a prime etiologic factor in this series. The only successful treatment in the author's experience consists of thorough cleansing of the canal with special attention being directed to the removal of all of the detritus from the anterior deep recess. It is his firm belief that success or failure depends on the cleansing of this area. After removal of the detritus, wicks soaked with a mixture of solution of lead acetate, solution of aluminum acetate and peppermint water are applied to the meatus twice daily. In most cases the condition responds to such treatment in a few days.

Other forms of treatment that have been employed with questionable success are discussed.

LE JEUNE and BAYON, New Orleans.

TREATMENT OF SUPPURATIVE OTITIS OF MORE THAN THIRTY DAYS' DURATION. ERIK L. HOFFMANN, Nord. med. (Hospitalstid.) **10**:1599 (May 24) 1941.

Of the 128 patients, 6 were adults, and in these bad results were shown. All the remaining 122 patients were children, of whom 13 had to be operated on at a later date. Of the

latter, 2 died and 11 were discharged with satisfactory results. One hundred and nine patients had received only conservative treatment and were discharged after more than thirty days (average seventy days); 90 per cent of them had satisfactory results, 7 per cent had less satisfactory results and 3 per cent died. The advantage of the conservative method of treatment is the infrequent need for operation (11.7 per cent of cases); the disadvantage is the long and expensive stay at the hospital.

WALLGREN, Göteborg, Sweden [AM. J. DIS. CHILD.].

Pharynx

A PHARYNGEAL SYNDROME PROBABLY OF VIRUS ORIGIN. ALBERT B. MURPHY, Ann. Otol., Rhin. & Laryng. **52**:391 (June) 1943.

Murphy reports 17 cases of a syndrome consisting of herpetic lesions in the pharynx and mouth, accompanied by pain in the ear and occipital regions and an area of paresthesia in the parietal region. These cases he encountered over a period of eighteen years and then within six weeks he saw an additional 20 cases. There was some variation in the two groups, but they were clinically similar. The chief complaint was a neuralgic type of pain in the ear, never lasting over one minute. It was aggravated by an increase in intracranial pressure produced by coughing. Examination of the ear showed no abnormality, and there was no diminution of hearing. The area of paresthesia over the parietal region is typical and covers an area approximately the size of the hand. There was usually no pain over this area and the hair simply felt as though it were crossed or brushed down the wrong way. The pharyngeal lesions varied from a single ulcer on the buccal membrane to a massive area of herpetic lesions covering the entire soft palate, both pillars and the posterior pharyngeal wall. The areas were not painful but were extremely sensitive to salt and to fruit juices. Seven of the 20 patients with the epidemic syndrome complained of severe pain in the occipital region of the affected side. This had not been noted in the previous cases. No pathologic organisms were found on culture, and from a laboratory standpoint the outstanding finding was a predominance of lymphocytes in scrapings from the base of the ulcer and from fluid aspirated from unruptured blebs. The blood count, the hemoglobin value, and the results of serologic tests seem of no significance. Ten of the 20 patients in this group also suffered from keratoconjunctivitis, and in these the pharyngeal syndrome seemed less severe. The adenopathy characteristic of the patients with keratoconjunctivitis was not noted in the group whose lesions were limited to the pharynx, but the preauricular node was enlarged in all patients with the ocular involvement.

The first 17 cases were considered of focal origin, and the possibility of origin in a virus infection was not given serious consideration until the recent outbreak of keratoconjunctivitis. In cases in which the contacts could be traced, the incubation period was from five to seven days. There were no general symptoms. The temperature rarely rose above 100 F. The ages ranged from 22 to 56 years. The highly contagious character was shown by 4 cases appearing in one family, some having the pharyngeal syndrome and others the keratoconjunctivitis. The average duration was twelve days.

Treatment was palliative, consisting of acetophenetidin and acetylsalicylic acid with codeine for pain, irrigations with a mild alkaline solution plus the application of dye antiseptics to the pharyngeal lesions, and large doses of vitamin B_1. Sulfonamide compounds did not affect the course of the disease. The neuritis, particularly that over the posterior occipital region, was of longest duration, some having occasional pain for four months after onset.

M. V. MILLER, Philadelphia.

TONSILLECTOMY IN YOUNG CHILDREN. P. PANNETON, Union méd. du Canada **71**:239 (March) 1942.

The consensus of physicians is that tonsillectomy should not be performed on children under 5 years of age except for extraordinary reasons. At the Crèche d'Youville 105 such operations were performed from 1935 to 1940. During that time there were 3,108 admissions to the orphanage. Four indications for the operation were considered: (1) repeated attacks of sore throat; (2) subnormal physical condition in patients in whom nothing beyond the local abnormality could be found; (3) chronic otitis media; (4) chronic coryza with tonsillar infection. Fifty-three of the children were between 2 and 3 years of age; 30 were between 1 and 2 years, and 3 were under 1 year. The average age rose during the study, the average in the first 20 cases being 18½ months, and in the last 20 cases, 34½ months.

The author points out that few grossly hypertrophied tonsils were encountered. Results were good; there were no complications. Only 52 per cent of the patients with otitis (25) were cured. The incidence of sore throat was diminished in most of the cases.

DAFFINEE, Boston [AM. J. DIS. CHILD.].

TONSILLITIS AND STOMATITIS CAUSED BY VACCINE VIRUS. GUNNAR ÖRN, Nord. med. (Hygiea) **11**:2714 (Sept. 20) 1941.

An unvaccinated girl of 4 years whose brother had been vaccinated with smallpox vaccine nineteen days previously fell ill with high fever and rapidly increasing pustules on the tongue and on the tonsils. The corneal reaction was positive. The child recovered.

WALLGREN, Göteborg, Sweden [AM. J. DIS. CHILD.].

Larynx

CONGENITAL ATRESIA OF THE ESOPHAGUS. M. FUHRMAN, D. DRAGUTSKY and G. ROOK, Radiology **38**:326 (March) 1942.

The authors report 2 cases of congenital atresia of the esophagus of the newborn infant. While reports of numerous cases have been published, only 2 were recorded for 12,285 deliveries in the maternity service of the Metropolitan Hospital in New York. The authors cite Vogt's classification: type 1, complete absence of the esophagus (rare); type 2, complete atresia with no tracheoesophageal fistula (rare); type 3 A, communication of the upper segment of the esophagus with the trachea (rare); type 3 B, blind termination of the upper segment and communication of the lower with the trachea or the bronchi near the level of bifurcation of the trachea (most common type); type 3 C, communication of both segments with the trachea or bronchi (rare).

In the 2 cases reported the condition was of type 3 B. The first infant regurgitated all feedings. Several attempts to feed by gavage were unsuccessful. After exploration with a soft rubber catheter and the discovery of an obstruction of the esophagus at the level of the third thoracic vertebra, a solution of barium sulfate was administered. This was immediately aspirated into the lungs, indicating an esophageal fistula. Death ensued that evening.

In the second case an opaque oil was used as the contrast medium in the exploration of the esophagus. After the roentgen examination the oil was removed from the esophageal pouch. The catheter could not be passed down the esophagus beyond the level of the bifurcation of the trachea. Gastrostomy was performed, and the patient did well for a fortnight. Then the tube became loose; after it had been replaced, death occurred. The necropsy examination showed atresia of the esophagus with a tracheoesophageal fistula.

The authors contend that the diagnosis can be made best without the use of a liquid contrast medium. They suggest that a soft rubber catheter be introduced through a naris into the esophagus and under fluoroscopic visualization be passed downward toward the stomach. With the patient in the Trendelenburg position, a small bulb syringe is attached to the proximal end of the catheter, and a few cubic centimeters of air is injected. The air will clearly outline the esophageal pouch. They emphasize the fact that gas in the intestinal tract indicates the presence of a fistulous communication between the lower segment of the esophagus and the respiratory passages.

ANSPACH, Chicago [AM. J. DIS. CHILD.].

OEDEMA OF THE GLOTTIS COMPLICATING MEASLES: A REVIEW OF EIGHT PERSONAL CASES. J. H. MULVANY, Brit. M. J. **1**:638 (May 23) 1942.

In the severe and widespread outbreak of measles occurring in the winter of 1929-1930 about 950 patients with measles were seen by the author of this article and his colleagues. Among these 950 patients there were 8 with severe edema of the glottis; 6 of these patients died, and 2 recovered. One of the latter managed to survive without operation, and 1 survived after tracheotomy. None of the other 6 patients was operated on. This report was prompted by a previous report of 4 cases of measles associated with laryngeal diphtheria.

The history and course in all the cases were very similar. It is pointed out that the edema occurring in the glottis usually occurs at about the time of the appearance of the rash and is associated with a slightly croupy cough, slow dyspnea and difficulty in swallowing. When these symptoms had begun, the patients of this study rather promptly manifested extreme respiratory distress, which became severe within a relatively short time. These symptoms are to be contrasted with those of laryngeal diphtheria, in which the onset is much more insidious and the respiratory distress is gradually progressive. Difficulty in swallowing, which is one of the clearcut signs in edema of the glottis complicating measles, is not found in laryngeal diphtheria, and this symptom alone should warn the physician of the urgency of

the situation. All of the 6 patients who died died with rapidly progressive asphyxia, which occurred within a period of twenty minutes to about two hours. It is urgently advised that when edema of the glottis complicating measles is suspected the patient be under constant and competent care so that operative intervention can be started in a minimal amount of time.

In his conclusions the author states that the mortality in untreated patients is probably not far short of 100 per cent and that edema of the glottis complicating measles is not an academic curiosity but is an entity which may confront a physician during any epidemic of measles.

BIRDSONG, University, Va. [AM. J. DIS. CHILD.].

Nose

DIABETES INSIPIDUS AND OTHER UNUSUAL COMPLICATIONS OF ACUTE PURULENT SINUSITIS: CLINICOPATHOLOGIC STUDY OF A CASE. J. C. YASKIN, F. H. LEWEY and G. SCHWARZ, Arch. Neurol. & Psychiat. **48**:119 (July) 1942.

The authors report the case of a 21 year old man who showed osteitis of the right lesser wing of the sphenoid bone as a complication of purulent sinusitis. The inflammation spread across the sella turcica and gave rise to changes in the optic nerves. After operation on the sphenoid sinus there developed successively subarachnoid hemorrhage, basilar meningitis and involvement of the floor of the third ventricle, with consequent diabetes insipidus and changes in the cerebrum, which eventually led to generalized convulsions, high fever and death.

Optic neuritis is not a rare complication of disease of the sphenoid and ethmoid sinuses, although there are observers who believe that retrobulbar neuritis is rarely, if ever, due to disease of the paranasal sinuses. In this case it was a striking feature in that the atrophy of the optic nerve developed during the period of observation in the hospital, in the course of a few days, undoubtedly as a result of the local inflammatory process around the optic chiasm and optic nerves.

IRVINE, San Francisco [ARCH. OPHTH.].

SUPPURATIVE ETHMOIDITIS WITH SPECIAL REFERENCE TO ORBITAL ABSCESS AND TREATMENT. DAVID IDE, Laryngoscope **53**:50 (Jan.) 1943.

Suppurative ethmoiditis may produce blindness or even death. The pus may get into the orbit through a dehiscence or by necrosis of the involved ethmoid bone.

Two cases are presented, one requiring operation and one conservative treatment.

HITSCHLER, Philadelphia.

THE NASAL ENTRANCE. W. RAYMOND MCKENZIE, South. M. J. **35**:433 (May) 1942.

In discussing the nasal entrance McKenzie states that the number of deformities occurring at this site is amazing. These deformities occur more often in males. And they are much more frequent in the white race. Nasal obstruction, either unilateral or bilateral, is the most common complaint of patients with these deformities. The obstruction may be due to a deformity of the nasal entrance, to a deflected septum or to both. Most of these deformities can be corrected by one operation and practically always through the incision used for a submucous resection. For good results all obstructing deformities must be corrected.

According to McKenzie, the more common deformities of the nasal entrance are: (1) curled or curved anterior edge of the septal cartilage, (2) deflected anterior edge of the septal cartilage, (3) deflected columella, (4) thickened columella, (5) elongated columella, (6) everted medial crura of the alar cartilages, (7) collapsed lateral crura of the alar cartilages and triangular cartilages, (8) congenital atretic nares and (9) any combination of two or more of the aforenamed deformities. The author describes his technic of examining the nose and briefly describes and illustrates most the various technics used in correcting the deformities named.

SINGLETON, Dallas, Texas.

Miscellaneous

THE PROGNOSIS OF PNEUMOCOCCIC MENINGITIS TREATED WITH CHEMOTHERAPY. G. HOLLANDER, Am. J. M. Sc. **203**:370 (March) 1942.

The clinical results obtained in 160 reported cases of pneumococcic meningitis treated with sulfonamide compounds bear out experimental results that sulfapyridine is the drug of choice.

At present there is no clear evidence that the use of specific serum with sulfapyridine should be a routine procedure. The percentage of recovery with sulfapyridine alone is approximately

that with the combined sulfapyridine-serum therapy. The combination is indicated in the treatment of type III and type V pneumococcic meningitis, in the treatment of infections secondary to an otorhinologic condition and to pneumonia, and in the treatment of younger patients.

No definite correlation could be made between the dose of the sulfonamide drug used, its concentrations in both blood and spinal fluid and the clinical response.

The prognosis is favorable if the cerebrospinal fluid has been sterilized within four days with the use of sulfapyridine.

Almost every type of pneumococcus has been cultured from patients with pneumococcic meningitis. With the exception of types III and V, there is little correlation between the type of organism and the prognosis.

The prognosis in pneumococcic meningitis secondary to pneumonia is poor, possibly because the invading organism has acquired tolerance to the sulfonamide drug.

The prognosis in the younger age groups is improved with the use of combined drug and serum therapy, with the best prognosis occurring in the age group from 10 to 20 years.

Of 9 patients with pneumococcic meningitis treated at Jefferson Hospital with sulfonamide compounds, only 1 recovered. Two others, infected with pneumococci of types III and X, had apparently recovered but died following unsuccessful treatment of a relapse. The patient who recovered received combined sulfapyridine and serum therapy.

HENSKE, Omaha [AM. J. DIS. CHILD.].

OCCURRENCE OF PERIPHERAL FACIAL PARALYSIS IN HYPERTENSIVE VASCULAR DISEASE. HAROLD R. MERWARTH, Ann. Int. Med. **17**:298 (Aug.) 1942.

In cases of malignant hypertension bleeding from small arterial twigs is common, the main pathologic changes being in the small arteries and arterioles. Reports of bleeding from small arterial vessels of slightly greater caliber within the facial canal should not meet with skepticism, since there is adequate postmortem proof of its occurrence.

Twenty-four cases were studied in which paralysis of the facial nerve was associated with hypertensive vascular disease. In 16 of these, in which the ages ranged from 10 to 73 years, a certain constancy of onset of the paralysis warrants setting them apart on the etiologic basis of hemorrhagic compression within the aqueduct of the facial nerve. In all cases the onset of paralysis was sudden. In no case was there preauricular or postauricular pain or a perverted sensation of taste. When these symptoms precede the onset of paralysis and are severe, the paralysis cannot be considered to be caused by hemorrhage.

PRICE, Philadelphia [ARCH. NEUROL. & PSYCHIAT.].

AGE INCIDENCE OF ATROPHY OF OLFACTORY NERVES IN MAN: A CONTRIBUTION TO THE STUDY OF THE PROCESS OF AGEING. CARLTON G. SMITH, J. Comp. Neurol. **77**:589 (Dec.) 1942.

Smith examined 205 olfactory bulbs procured at autopsy from 121 persons of known age and sex who were free from intracranial disease. The ages ranged from birth to 91 years. By counting the number of olfactory glomeruli he was able to estimate the number of fibers which reached a given bulb. The fibers began to disappear shortly after birth and continued to disappear at the rate of approximately 1 per cent a year. No difference in loss of fibers between the sexes was observed. Some subjects had entirely lost the olfactory fibers at the age of 20, and few had a normal count after the age of 50.

FRASER, Philadelphia [ARCH. NEUROL. & PSYCHIAT.].

SULPHAPYRIDINE AS AN AID TO THE POST-OPERATIVE TREATMENT OF LARYNGEAL DIPHTHERIA ASSOCIATED WITH MEASLES. D. F. JOHNSTONE, Brit. M. J. **1**:325 (March 7) 1942.

Laryngeal diphtheria associated with measles is rather rare, and in the author's experience most patients with this combined condition have died of bronchopneumonia. Because of encouraging results obtained by giving sulfapyridine in the treatment of measles and its complications, this form of therapy was used for 4 children with laryngeal diphtheria associated with measles, and all of them recovered. BIRDSONG, University, Va. [AM. J. DIS. CHILD.].

ALLERGY, ENURESIS AND STAMMERING. I. GORDON, Brit. M. J. **1**:357 (March 14) 1942.

This article is an investigation as to the incidence of enuresis and stammering in patients with allergic diseases. Of 128 bed wetters 65 per cent either had a history of allergy in the family or had allergy themselves. In a control series the figure was only 28 per cent. Of

the various classes of allergy, migraine was by far the most common, with a 48 per cent incidence, asthma, hay fever and eczema being less frequent in that order. Because of the high incidence of a history of migraine found in cases of enuresis, the incidence of headaches was then obtained in the children with enuresis. In the control group only 13 per cent of 200 normal patients complained of headache, while of 50 bed wetters 44 per cent complained of severe headaches.

In the discussion the author points out that it has long been established that persons with asthma suffer from somewhat abnormal mental states, usually of a minor and vague type. It is also noted that asthmatic attacks are often brought on by some psychologic stimulus. Because of the universal use of a headache as an excuse to retire from some embarrassing or unfavorable situation, it is pointed out that it is not surprising that headaches are found frequently in bed-wetting patients. In his summary the author makes the following statements:

"It is confirmed that enuresis and stammering are commoner among allergics.

"It is suggested that among the manifestations of allergy migraine is largely associated with these two complaints, and in fact that headaches of various types may be a factor in the aetiology.

"This being the case, as well as the fact that nightmares are so common in allergic children, it is suggested that enuresis and stammering are not themselves direct allergic manifestations but result from the abnormal psychological traits of allergics."

BIRDSONG, University, Va. [AM. J. DIS. CHILD.].

News and Comment

CASSELBERRY AWARD OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION

A sum of money having accrued from the Casselberry Fund of the American Laryngological Association, a prize will be offered in 1944 for papers on original investigation in the art and science of laryngology or rhinology. These must be in the hands of the secretary, Dr. Arthur W. Proetz, 1010 Beaumont Building, St. Louis 8, Mo., before March 1, 1944.

EXAMINATIONS IN OTOLARYNGOLOGY AND OPHTHALMOLOGY

American Board of Otolaryngology.—An examination will be held in New York, at the Waldorf-Astoria Hotel, on June 1 to 4, 1944.

American Board of Ophthalmology.—An examination will be held in New York on June 3 and 4, 1944 and in Chicago on Oct. 5, 6 and 7, 1944.

Further information with respect to examinations may be obtained from the secretary-treasurer, Dr. S. Judd Beach, P. O. Box 1940, Portland 2, Maine.

The other officers for 1944 are: chairman, John Green, M.D., St. Louis; vice chairman, Frederick C. Cordes, M.D., San Francisco, and assistant secretary, Theodore L. Terry, M.D., Boston.

CORRECTION

In the article by Dr. George Kelemen entitled "Pathway of the Tonsillar Lymphocyte," in the November issue (ARCH. OTOLARYNG. **38**:433, 1943), the letters "B" and "C" in figure 3, page 438, and in figure 4, page 439, should be exchanged reciprocally. In the last line of the legend for figure 3, "projection in B" should read "projection in C."

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

G. HENRY MUNDT, M.D., *President*

WALTER THEOBALD, M.D., *Secretary*

Regular Meeting, April 5, 1943

Anatomy of the Tracheobronchial Tree from the Bronchoscopic Standpoint: Study of Twenty Pairs of Lungs; Preparation of Lungs for Demonstration. DR. E. W. HAGENS.

This article was published in full in the November issue of the ARCHIVES OF OTOLARYNGOLOGY, page 469.

DISCUSSION

DR. JOHN F. DELPH: It is rather difficult to add anything to Dr. Hagens' excellent presentation. My experience from the anatomic standpoint has been limited. However, I like his approach to the subject from a new angle, that is, from the inside looking out, which is as it should be. The textbook approach is from an angle entirely different from that of the bronchoscopist. One can see beyond the end of the bronchoscope but not through the tracheal or the bronchial walls to know what is above or below the end of the scope. This better knowledge of the associated anatomy is useful. The major proportion of bronchoscopic examinations are performed for therapeutic drainage of bronchiectatic cavities or of abscesses of the lungs, and a smaller number for removal of foreign bodies or biopsy specimens. Usually the location of the lesion has been fairly well established beforehand through the use of the roentgen rays and contrast mediums, and ordinarily it is not difficult to proceed directly to the site; with removal of the specimen for biopsy or of the foreign body, it is usually unnecessary to proceed further.

From Dr. Hagens' paper, however, I can see that there are many areas in the lung left unexplored by the usual bronchoscopic procedure. In the obscure case of hemoptysis or of purulent discharge one is able to proceed with more certainty if one has firsthand knowledge of the bronchial pattern. True, 20 pairs of lungs cannot give exact details for all lungs, but this study helps to standardize the picture and adds to the work of Huizinga and Behr and De Pablo, mentioned by Dr. Hagens.

Undoubtedly there is considerable anatomic variation in the tracheobronchial tree, and it will take considerable time and study to give an accurate picture, but these studies are a valuable addition to what is already known from Jackson and co-workers. There is apparently a regular irregularity about the whole scheme of branches and subbranches which gives rise to a constant and fixed gross pattern within the lung. If this is kept in mind, one can better understand what one is doing when one passes a bronchoscope and be better prepared to seek out the lesser branches for obscure lesions. There are many cases in which physical and roentgen findings are of little help, but with further knowledge of the anatomy, new light should be shed on these cases. Undoubtedly, lesions occur in the smaller bronchi that cannot be entered with an average size bronchoscope, but if one knew the approximate location of the mouth of the bronchus, perhaps an aspirator or a forceps curved to suit the purpose could be used to good advantage, as in entering the bronchi to the upper lobes.

Huizinga and Behr stated that the left main bronchus always divides into two practically equal branches, the bronchi of the upper and lower lobes. The bronchus for the upper lobe invariably runs off laterally. It usually divides into two branches, the upper and the lower. Dr. Hagens' dissections confirm these statements. In examining the left lung one should examine the upper lobe mouth first. The technic described by Jackson and Bruning is well known. The first dorsal bronchus of the lower lobe is a large branch which serves an important lung segment in which inflammations are often located. This branch runs off on the posterior side at about the height of the upper lobe bronchus, or a little lower. To see the opening the head must be brought well forward, and if the head is brought back to normal position, the tube can be pushed farther into the lower lobe bronchus, bringing the remaining portion into view.

On the right side the procedure is somewhat reversed. The bronchus leading to the upper lobe is examined first, then the bronchus to the middle lobe and the ventral branch just below

it, and then the bronchus to the lower lobe. These definite procedures are made possible by the studies submitted by Dr. Hagens and others, and I believe that with their help the laryngologist can further improve his aid to the roentgenologist, the internist and the thoracic surgeon and probably eventually seek out and explore some ramifications of the tracheobronchial tree which are less well known from a bronchoscopic standpoint.

The observations on the blood vessels about the hilar region serve to caution against injudicious use of the biopsy forceps and to bear in mind the possibility of disaster if one is too bold.

DR. PAUL HOLINGER: Dr. Hagens has added a great deal to the information about the bronchial tree. I know from the beautiful description he has had mimeographed for the members that his work has been much more extensive than what he has just shown.

Lyman Richards raised a question recently of "bronchoscopy at the crossroads." He mentioned that bronchoscopy had been started and fostered by otolaryngologists and that the thoracic surgeons had taken it over. Was the otolaryngologist going to continue, or was the thoracic surgeon going to take over bronchoscopic work? These questions are answered in part by work such as this. From what Dr. Hagens has told the members there is much more to bronchoscopy than looking into the bronchoscope to find a foreign body or to examine a major bronchus. If otolaryngologists fail to realize this, they overlook many of the more important phases of bronchology. One must understand the segmental distribution of certain disease processes, and if one examines segments of the lung instead of simply lobes, one can correlate the bronchoscopic and the surgical aspects of pulmonary pathology. The thoracic surgeon can remove segments of a lobe rather than the entire lobe and has to determine the segment involved. He can be aided greatly in determining before surgical intervention the extent of diseased tissue and that of normal tissue. The most pertinent illustration of this is the lingula of the left upper lobe, which is somewhat analogous to the middle lobe on the right side. It is so frequently involved in bronchiectasis of the left lower lobe that prior to lobectomy the bronchologist must be able to state whether or not it is to be removed with the lower lobe.

From the standpoint of classification the anatomist classifies the bronchi as posterior or lateral or medial; the clinician and the thoracic surgeon have a different terminology which they have developed from a bronchoscopic standpoint, and the effort to correlate these was, I believe, Dr. Hagens' reason for making this study. The terminology used by the bronchoscopist is important because it stresses the clinical rather than the anatomic standpoint.

I have noticed in examinations the natural variations in the diameter of the bronchi which were mentioned, particularly when I have used photographic apparatus. Ordinarily I use much larger bronchoscopes in photography; yet these can enter the bronchi very easily. Extreme bronchial flexibility must also be considered.

I want to thank Dr. Hagens for his emphasis on the anatomy and terminology of this particular area, in which the otolaryngologist must keep pace with the thoracic surgeon.

DR. E. W. HAGENS: I want to thank Dr. Delph and Dr. Holinger for their discussions. Some one asked about preparation of the lungs. It is not necessary to do anything except to inflate them. I try to get the blood out of the lungs because I believe it may cause some decomposition, but otherwise they dry and remain in good shape.

Educational Services to Deaf and Hard of Hearing Children in the Chicago Public Schools. MAJOR FRANK L. BEALS, Assistant Superintendent of Schools (by invitation).

The story of the development of education for acoustically handicapped children reads more like fiction than factual history. Across the screen of this history pass men of miracles, philosophers dominating medical fact, the romance and the neglect of lip, or speech, reading, the codes, the development of schools and the battle between oral and manual methods until finally, in 1902, the definite recognition of and attempts to meet the needs of these children.

Much of the difficulty in developing education for the deaf and hard of hearing children arose from what Aristotle had to say about them. In about the third century B. C. he said: "Those born deaf all become speechless; they have a voice but are destitute of speech." Further, he called the ear the organ of instruction and said: "Of all the senses, hearing contributes most to intelligence and knowledge."

Under the early Roman law deaf persons were classed as incapable, along with madmen and infants. Legal guardians were appointed for them, since they were considered unable to perform any legal acts in their own behalf. A person who was slightly deaf was considered adventitiously deaf or as a deaf person giving evidence of intelligence; such a person required no guardian or curator. In the sixth century A. D. the Emperor Justinian commissioned great

jurists to prepare a code which bears his name. In the purview of this code were included the persons who were deaf, and they were divided into five categories:

1. Those deaf and dumb by nature: They were considered wholly lacking in intelligence, and legally they were not permitted to make wills or contracts or to act as witnesses.

2. Those deaf and dumb by accident or disease: This was considered the adventitious group. If these persons had acquired a knowledge of language, they were permitted to make wills and contracts and to perform other legal actions; they were also permitted to marry.

3. Those deaf from birth who were not dumb: These also were considered in the adventitious group.

4. Those deaf not from birth but by accident: They were not restricted by law from normal participation in affairs of everyday life.

5. Those dumb who were not deaf: They had, if educated, full legal rights.

This code of Justinian became the basis of later Latin law. The Hebraic law contained an injunction not to curse the deaf person. In the Talmud those who were deaf and dumb were placed on the same footing as fools and children. However, the Talmud did go to the length of stating that the deaf person could be taught. The early Christian philosophy taught that deaf persons were uneducable.

However, in spite of the uncompromising philosophy underlying the treatment of deaf persons at the time, certain people recognized and developed outstanding ability in some of those who were deaf. Pliny, who lived between 23 and 79 A. D., said of the grandson of one of the Roman consuls, "This young man, being a mute from birth, the orator of Mesala, of whose family he was, thought he might be instructed in painting, of which also Augustus, of sacred memory, approved. The young man made great proficiency in that art." Deaf painters and other deaf artists have achieved works of note and have been accorded high rank among the artists of their time in Spain, France, Italy, Germany, Holland and the United States.

It was not until 1500 A. D. that there was a change in the point of view with reference to educating deaf persons. It is reliably reported, however, that the Venerable Bede, in 685 A. D., made a dumb boy learn to speak and read the lips. This was regarded as a miracle. In the Church of England St. John of Beverly is the patron saint of the deaf. However, it was Pedro Ponce de Leon, a Spanish Benedictine monk, who was the first recorded teacher of the deaf. His work was carried on in the monastery of San Salvador at Ona. He taught speech, reading, writing and arithmetic. Some of his pupils were taught Latin, Greek and Italian. The methods employed by Pedro Ponce de Leon are interesting. They included: writing the names of objects, saying them, associating the two with pantomime and a manual alphabet.

But enough of the history of education of the deaf and hard of hearing; with the more modern history every one is thoroughly familiar. The Chicago Public School System provides for the education of deaf and hard of hearing children through classes at five elementary and three high schools.

Organization and Administration of the Audiometric Service in the Chicago Public Schools. KATHERINE BARRETT, Coordinator for Handicapped Children.

Prior to 1935 the examination of children for defective hearing was not carried on with any definite plan in the Chicago Public Schools. Children who showed evidence of a serious handicap were placed in a special school. They were examined by private physicians or otologists, or in some cases at the Bureau of Child Study. Such procedures were most inadequate in caring for children in the schools as a whole. In 1936 a systematized plan was inaugurated to test children already placed in the special schools. This work was carried on by staff psychologists of the Bureau of Child Study, and through this audiometric service for children already handicapped the need for further and more extensive testing of all school children was brought out.

In May 1938 a Works Progress Administration project was started whereby the whispered voice test was used as a screening test in all schools, and children who failed in this test were sent to the Bureau of Child Study for further examination; here the individual audiometric test was given to determine the decibel loss of hearing. Case histories were taken on all these children and were considered vitally important because they aided in understanding the causes, made more clear many of the differential diagnoses sent in by attending physicians and otologists and were helpful in planning the pedagogic and auricular programs. This program was carried on until 1940, during which period 297,172 children were tested. Of this group, 5,576 children were referred to the Bureau of Child Study for further examination, and 9,638 were given advantageous seating in the classrooms.

The whispered voice test was discontinued in the fall of 1940, and in its place various audiometer tests were started both for screening and for individual testing. In a thirteen month period 69,108 children were tested; 3,221 showed hearing defects of varying degree and 980 of them were referred for further study.

There are at present five elementary schools acting as centers for deaf and hard of hearing children, and three centers at the secondary level, two caring for boys and girls and one, a technical school, exclusively for boys. There is one center at the Spalding School for Crippled Children teaching children with various handicaps, crippled, deaf or hard of hearing. There is one center at the Washburne Vocational School for boys and girls. Children are sent to these special centers on the basis of best transportation facilities. All the special centers are equipped with multiple hearing aid machines.

For acoustic training children are divided into three groups: (1) profoundly deaf; (2) congenitally deaf with a small residuum of hearing; (3) hard of hearing. It is felt that children who are profoundly deaf, especially those in whom deafness occurred before speech was developed, will in all probability never build up a hearing vocabulary, but the psychologic effect of acoustic training is valuable. The congenitally deaf group usually includes a large number of children whose audiograms and case histories indicate some residual hearing that has not been developed. In a few instances, after some acoustic stimulation the child has been found to have a hearing vocabulary, although he may be unable to interpret sound correctly.

The hard of hearing children are divided into those with severe and those with mild loss of hearing. The ones with severe losses are given acoustic stimulation and voice and speech training, the same as a deaf child receives, for the establishment of correct speech habits. The ones with mild losses may have most of their academic work programed to regular grades, but acoustic training is carried on with a group approximating their own level of development.

The W. P. A. project for screening the hearing of all school children has been of great value because it gives early detection of defective hearing. The individual audiometer examination gives the definite decibel loss of hearing and the type of defect. It points to the need for advantageous seating in the classroom, for transfer to a division of hard of hearing or deaf pupils, or for otologic care. There is no doubt but that the acoustic methods employed and the electrical hearing aid stimulation are beneficial for the children transferred to the centers.

Studies of case records over a period of years indicate that there is an increased loss of hearing acuity as the child grows older. This would appear to indicate that the earlier a child with defective hearing is found and otologic care and correct school placement are initiated, the better the possibilities of saving the hearing from further loss. Moreover, the beginning early to use acoustic methods, to improve speech and to train in lip reading aids the child socially and educationally.

It is felt that with proper individualized training at the child's level of achievement there is no reason to discount the ability of hard of hearing children.

DISCUSSION

DR. ALFRED LEWY: I was enthralled by Major Beals's all too brief historic review of the subject of the education of the deaf and greatly interested in Miss Barrett's statistical review of the work done in the Chicago schools. Major Beals is to be congratulated on the excellent showing made by the schools and particularly on the devotion shown by the teachers of the deaf to their charges and their life work.

It is to be remembered, however, that nearly all the movements in the large cities for the discovery of deaf children in the schools and the application of remedial measures, to say nothing of the detailed study of the causes of deafness, have been initiated by members of the medical profession. In the years 1927 to 1929, under grants from the Rockefeller Foundation and the National Research Council, a survey of the public schools was made under the direction of Dr. George Shambaugh Sr., assisted by Drs. Curry, Hagens, Hall, Holderman and Watkins; later, Dr. Norval Pierce and Dr. John Theobald surveyed the State School for the Deaf at Jacksonville, Ill. In 1932 Dr. Ballenger as president of this society appointed a committee consisting of Dr. Joseph C. Beck, Dr. Shambaugh Sr., Dr. Hagens, Dr. Theobald and myself as chairman, to cooperate with the public schools of the city in the investigation and treatment of deafness. Dr. McMillan, in charge of the child study department, and later his successor, Dr. Munson, cooperated with us. At the beginning twelve doctors, mostly members of this society, gave their time and energy, without pay, in visiting the schools, instructing teachers in the whisper test and directing those in need of treatment to selected clinics which had agreed to cooperate with us.

At that time the principals of the schools tried to help us so far as they could, but with their multifarious duties it soon became evident that paid helpers would be necessary if we

were to give hearing tests to all the children. Dr. Bogan, then superintendent of schools, appointed a medical advisory committee, consisting of at least one representative of each branch of medicine, with the object of extending complete medical examinations to the school children. With his death I believe that committee went out of existence. Dr. Hayden, then president of the Chicago League for the Hard of Hearing, believed that the screening tests should be done by audiometer, while our committee believed the whisper test would be adequate for this purpose and would not entail the expense of extra equipment. As the result of this disagreement we did not have the cooperation of that league. The expected W. P. A. grant was slow in materializing, but with the cooperation of Dr. Munson classes of school principals were instructed in the technic of the whisper test, and they were to transmit this to their teachers. In the meantime the doctors of this society examined in detail at their offices, without charge, such special subjects as were referred to them by the schools for the deaf and the department of child study.

Members of women's clubs furnished volunteers who saw to the transportation and chaperonage of these children. Several women's clubs were active in this work, in particular the Chicago Women's Aid. They donated group hearing aids to at least two schools for the deaf, and they also were responsible for the placing of hearing aids in a number of theaters and churches. I must mention in particular that dynamic personality, Mrs. Sadie Pelton, working through the women's clubs, keeping after us to get things done and getting them done finally.

After the W. P. A. took over the work of giving the whisper test to school children, I furnished Major Beals with the names and addresses of several members of this society who would, without charge, examine clinically such children as required special attention, as we had been doing before. I do not know how much follow-up work has been done to insure treatment of those found in need thereof. This is the ultimate essential, and I can assure Major Beals that this society stands ready to cooperate in this.

DR. GEORGE WOODRUFF: Is the incidence of hard of hearing children increasing in the first grades?

DR. ELMER HAGENS: Is it true that the percentage of children with deafness has increased in the older groups?

MISS KATHERINE BARRETT: An increase has been noted with each grade; in the last year of high school the percentage was 11.1.

DR. ELMER HAGENS: In our survey my associates and I found two large groups of children, the one with congenital and the other with acquired deafness. In the latter group, 70 per cent had acquired deafness at the age of 5. One would think there would be less increase because of the lesser incidence of infectious disease in older children. Most deafness is acquired by way of the inner ear. It would be interesting if children surveyed could be followed up as they grow older, with reference to the percentages of those with congenital and those with acquired deafness.

MISS KATHERINE BARRETT: I should like to ask why an otologist reports that a child has normal hearing or sufficiently good hearing to stay in the normal grades when we have audiograms that show definite loss of hearing?

DR. THOMAS C. GALLOWAY: One difficulty is to agree on standards which should determine whether a child should have special training. Some children with a 40 decibel loss in higher frequencies hear speech satisfactorily, whereas others with a 30 decibel loss may not. Much depends on the intelligence and the alertness of the child, as well as on other factors, such as the type of impairment. Some standards should be worked out, as definite as may be feasible, for school authorities to use in governing such cases.

Directory of Otolaryngologic Societies *

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Claude C. Cody, 1304 Walker Ave., Houston, Texas.
Secretary: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia.
Place: Chicago. Time: June 12-16, 1944.

American Academy of Ophthalmology and Otolaryngology

President: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
President-Elect: Dr. Lawrence T. Post, 508 N. Grand Blvd., St. Louis, Mo.
Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.

American Broncho-Esophagological Association

President: Dr. Robert L. Moorhead, 125 Ramsen St., Brooklyn.
Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago.

American Laryngological Association

President: Dr. Charles J. Imperatori, 108 E. 38th St., New York.
Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. H. Marshall Taylor, 111 W. Adams St., Jacksonville, Fla.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.

SECTIONS:

Eastern.—Vice President: Dr. Westley M. Hunt, 907—5th Ave., New York 21.
Place: New York. Time: Jan. 14, 1944.

Southern.—Vice President: Dr. William C. Warren Jr., 478 Peachtree St. N. E., Atlanta, Ga.
Place: Atlanta, Ga. Time: Jan. 8, 1944.

Middle.—Vice President: Dr. Fred W. Dixon, 2060 E. 9th St., Cleveland.
Place: Cleveland. Time: Jan. 12, 1944.

Western.—Vice President: Dr. Simon Jesberg, 500 S. Lucas Ave., Los Angeles.
Place: Los Angeles. Time: Jan. 22-23, 1944.

American Otological Society

President: Dr. Wesley C. Bowers, 17 E. 61st St., New York.
Secretary: Dr. Isidore Friesner, 101 E. 73d St., New York.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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